REMOVAL ASSESSMENT REPORT
FOR
RED AND BONITA MINE
SILVERTON, SAN JUAN COUNTY, COLORADO

Prepared for:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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LIST OF ABBREVIATIONS AND ACRONYMS

CR	County Road
DRMS	Colorado Division of Reclamation and Mine Safety
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
ERRS	Emergency and Rapid Response Services
gpm	gallons per minute
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
RPD	relative percent difference
SPI	Secondary Permeability Index
START	Superfund Technical Assessment and Response Team
TCLP	Toxicity Characteristic Leaching Procedure
TDD	Technical direction document
UOS	URS Operating Services
USGS	U.S. Geological Survey
WESTON	Weston Solutions, Inc.

1 INTRODUCTION

The United States Environmental Protection Agency (EPA) tasked the Weston Solutions, Inc., (WESTON®) Superfund Technical Assessment and Response Team-4 (START) under Technical Direction Document (TDD) 0001/1306-05 to provide technical support for a removal assessment at the Red & Bonita Mine site (Site) near Silverton, San Juan County, Colorado. Assessment included mine entries during 2013 and 2014 to characterize the workings of the Red and Bonita Mine. The Red and Bonita Mine discharges approximately 300 gallons per minute (gpm) of mine impacted water that impacts water quality in Cement Creek and downstream waters. The mine is being investigated to determine potential means of reducing the impacts of the mine to downstream waters.

During 2013, the Red and Bonita tunnel was mapped and the mine geology and hydrogeology were characterized. During 2014, a packer test was performed to determine the suitability of a potential bulkhead location. Support activities included air monitoring, mine ventilation, water and solids management, and water sampling.

This report describes the mine entries, evaluation methods and results, support activities, and analytical results from the 2013 and 2014 site work. Section 1 is a brief description of the objective and scope of the removal assessment, Section 2 provides a brief description of the site and its known history including EPA work performed during 2011 and 2012, Section 3 describes 2013 and 2014 assessment activities, Section 4 describes the packer test and results, Section 5 describes water and solids management setups for 2013 and 2014, and Section 6 describes sampling and analysis. Photos are presented in Appendix A, supplemental water and solids management information is provided in Appendix B, Division of Mining Reclamation and Safety reports are presented in Appendix C, and packer test background and procedure are presented in Appendix D. Laboratory analytical reports are provided in Appendix E.

2 SITE BACKGROUND

2.1 SITE DESCRIPTION

The Red and Bonita Mine is located in San Juan County, Colorado approximately 7 miles north of the town of Silverton (37.897302 north and 107.643883 west) (Figure 1). The portal elevation is 10,893 feet above mean sea level. Road access is via County Road (CR) 110 from the town of Silverton to CR53 at the abandoned town site of Gladstone. CR53 continues northward up the Cement Creek valley to the mine site, approximately ¾ mile north of Gladstone. The site lies east of Cement Creek on a west-facing mountainside slope with an average 44 percent grade. The mine is accessible during non-snow months of the year, typically late June through early October.

The Red and Bonita Mine site consists of a 1.25 acre waste rock dump and an estimated 3500 feet of mine workings that drain approximately 300 gallons per minute (gpm) throughout the year. Adit discharge flows across a work pad at the top of the mine dump and approximately 200 feet down the waste rock/tailings dump face before being channelized at the toe of the dump. The channel directs flow into an iron bog en route to Cement Creek approximately 500 feet downgradient of the toe of the dump. Cement Creek enters the upper Animas River watershed in Silverton. The Animas River and many of its tributaries, including Cement Creek, carry high concentrations of metals from both acid rock/mine drainage at mine sites and from natural sources not impacted by mining. Water quality studies have indicated that the Red and Bonita Mine is one of the major sources of metals to the Animas River near Silverton. Several other mines in the Cement Creek basin above Gladstone also have draining adits, including the Gold King Level 7, the Grand Mogul, and the Mogul mines.

2.2 SITE HISTORY AND PREVIOUS ASSESSMENTS

Mining began near Silverton in 1871 and lasted until as late as 1991. Historic mapping of the Red and Bonita Mine indicates that it was advanced predominantly prior to 1899. Mining operations lasted a short period but no activity occurred after the initial operations, which apparently ceased with in a few years . Additional information regarding mining in San Juan County is provided in the National Register of Historic Places.

Multiple agencies and organizations, including EPA, have been monitoring water quality, contaminant loading, and the resultant risks to human health and the environment in the Animas River watershed since the early 1990s. The Animas River Stakeholders Group (ARSG) formed as an ad hoc watershed group to work on various projects related to the mining impacts to the river. Over a period of approximately 20 years, the group has participated in various projects to manage mine waste and to reduce the flow of contaminated water from a few mines in the watershed. In addition, under the terms of a consent decree with the State of Colorado, Sunnyside Gold Mine Company performed several large scale projects related to historic operations on properties associated with the company's operations. One project was plugging (installing concrete bulkheads) within the Sunnyside mine workings, including the American Tunnel, during the period from 1996 to 200 2. The American Tunnel is located in Gladstone, approximately ¾ mile south of the Red and Bonita Mine. During the mine operation, the American Tunnel discharged approximately 1,700 gpm of metal laden water and was treated prior discharging to Cement Creek. Following the installation of the last of the three plugs, flow from the American Tunnel has decreased to approximately 100 gpm, the result of leakage around the concrete bulkhead.

The flow from the Red and Bonita Mine, the Gold King (Level 7) Mine, and the Mogul Mine all experienced significant increases in flow following the plugging of the American Tunnel. Since bulkhead installation, the Red and Bonita discharge rate has increased from negligible to over 300 gpm. The pH of discharge water typically measures between 5 and 6. The pH decreases significantly when metal oxy-hydroxide sediments and precipitates are stirred up by activities within the mine. Contaminants include low pH and metals. Cadmium concentrations from the mine discharge ranged from 33.3 micrograms per liter (µg/L) to 39.3 µg/L, copper concentrations ranged from 4.5 µg/L to 50.6 µg/L, iron concentrations range from 76,700 µg/L to 97,600 µg/L, lead concentrations ranged from 34 µg/L to 71.2 µg/L, and zinc concentrations ranged from 13,600 µg/L to 17,500 µg/L. Additional information regarding the Animas River watershed in San Juan County is provided in scientific papers that were compiled by the U.S. Geological Survey (USGS) (Church et al 2007).

2.2.1 2010 and 2011 Mine Work

The mine water discharge occurred through a collapsed rock debris blockage for an unknown number of years. The following work was performed to investigate and open the mine tunnel (URS Operating Services (UOS) 2012a).

- A groundwater monitoring well was drilled into the Red and Bonita tunnel in September 2010. A pressure transducer was installed to measure temperature, conductivity, and static water levels and to provide insight into conditions of the pool of water backed up behind the portal blockage in anticipation of removing the blockage the follow year.

- The north road used to access the portal area was improved. The work area at the top of the waste rock dump w as improved by placing 1-inch to 12-inch rock debris over solid precipit ates that armored the pad, covering the surface with geotextile, then adding a 6- to 12-inch layer of talus material.

- Diversion channels were constructed to divert adit flow as necessary for operations including allowing it to flow its natural course over the dump or into piping to manage the discharge during underground work. A sump was excavated near the mine portal to allow the flow to be captured in a pipe and allowed to either flow down the face of the waste rock pile during inactive work periods or into piping during active work periods.

- During excavation of the blockage and underground work, water discharged from the mine was routed from the sump to filter bags placed on the work pad at the base of the waste rock dump to collect any solids. As necessary during the blockage removal, the pooled water was pumped from behind the blockage into 6-inch PVC piping to four filter bags connected with a manifold system at the toe of the waste rock dump. Liquid aluminum sulfate flocculant was added to water at a rate of 30 to 100 gallons per day. An additional filter bag was placed at the outfall of a culvert pipe under CR53.

- A 10 foot diameter and 10 foot long corrugated galvanized metal pipe was installed at the portal structure and a secure metal barrier with a locking door was added to restrict access. The portal structure was built into a mostly competent ferricrete mass entering the tunnel.

- A limited investigation of the mine was conducted, but in-mine work was abandoned when monitoring indicated inadequate oxygen in the air. No toxic gasses were detected.

- Review of historic mining information and aerial photographs did not show other openings into the mine, and this was partially confirmed in that air did not appear to be moving through the mine.

2.2.2 2012 Mine Work

The workings in the Red and Bonita Mine were investigated and mapped during a June 2012 mine entry (URS Operating Services, Inc. (UOS) 2012b). The following work was performed during 2012:

- The rock structure and water sources entering the workings were evaluated to determine the potential for implementing hydraulic controls. The underground assessment work was performed by a team including mining engineers and a geologist with the DRMS, supported by EPA.

- An attempt was made to confine flow into flexible pipe using a series of sandbag coffer dams constructed in the first hundred feet mine to slow the flow of water and allow the sludge to accumulate. This proved unsuccessful as a means of reducing the discharge of solids.

- The investigation of the first 680 feet in the mine tunnel indicated the following:

  1) The first 680 feet was open without blockages/collapses;

  2) The tunnel is in a competent andesitic rock requiring little to no support;

  3) 0.5 feet to 3 feet deep sludge covered the entire 680 foot distance. The extent and depth of the precipitate contributed to waist-deep mine water in some areas, making mine entries difficult.

- A water inflow of approximately 10 gpm was observed from a small drift located at approximately 283 feet into the tunnel, while the remainder of the approximate 300 gpm flow was from beyond 680 feet.

- Approximately 2 to 3 feet of solid precipitates was present in the mine. Solids were mobilized and released from the mine when people walked through the sludge during mine entries. The solids content in the flow exiting the mine increased significantly when the settled solids in the tunnel were disturbed during mine entries; therefore, water discharged during mine entries was directed through filter bags prior to discharge toward Cement Creek. Flocculant (alum) was added to assist in the solids settling/filtration rate, which was somewhat improved. It was noted that while the adit discharge water pH typically ranged from 5 to 6, the pH decreased to between 2 and 4 during mine entries.

- In-mine work ceased when the maximum capacity of the filtration system w as reached and expansion for additional filter bags was not feasible at that time. Construction of a settling pond was not an option until later when access was granted by the adjacent landowner.

- The filter bag solids were dried and sampled. Toxicity Characteristic Leaching Procedure (TCLP) analytical results indicated that the solids did not exceed Resource Conservation and Recovery Act (RCRA) hazardous waste limits (Table 1, from UOS 2012). The spent filter bags from 2011 and 2012, containing an estimated 5 to 7 tons of mine drainage filtrate, were transported to the Bondad Landfill in Durango, Colorado, for disposal in July 2012.

Subsequent to the entry in June 2012, the owner of the Success Placer claim on the west side of CR53 opposite the Red and Bonita waste rock dump agreed to allow access for EPA to construct a settling pond to assist in capturing the solids in the discharge water. The area was evaluated prior to pond construction. Mill tailings observed on and below the ground surface, possibly from a stamp mill that operated at the mine, had elevated metals concentrations: iron (437,000 to 444,000 mg/kg), lead (1,500 to 1,800 mg/kg), and zinc (1,200 to 1,500 mg/kg). Mercury was detected in a surface sample. The settling pond was excavated in October 2012.

3 REMOVAL ASSESSMENT

3.1 REMOVAL ASSESSMENT – 2013

EPA conducted mine entries and support activities from August 5 to August 15, 2013 to map the mine , evaluate the rock conditions, identify inflows of water and collect mine water samples. Construction work outside the mine was performed by Environmental Restoration (ER) , EPA's ERRS contractor. Underground mining support work was performed by Frontier Environmental. The water and solids management system was operated by ER and START personnel. DRMS, EPA, and Frontier Environmental performed the mine investigations.

3.1.1 Underground Mapping and Preliminary Bulkhead Siting Evaluation

The primary objective during this phase of the assessment was to determine where water inflows originate, examine the extent of the workings to the degree possible, and determine if any connections to other mines were present. The accessible workings were limited to approximately 2000 feet of an estimated 3500 feet. The following work was performed during 2013:

- Site Preparation

- The water diversion arrangements on the waste dump outside the portal were modified to provide better control of the discharge from the mine. The existing 8-inch pipe was removed and the 14-inch pipe was repositioned to capture all of the mine water from the retention pond and direct it to the edge of the waste rock dump, doubling the work area and sealing the work pad from leakage.

- The roadside drainage ditch along CR53 was improved to increase the freeboard in the ditch and prevent road damage from water from flowing over CR53.

- Mine ventilation system installation

  - In-mine oxygen levels exceeded 19%, the minimum level for safe work conditions, prior to ventilation during previous mine entries. However, ventilation with the fan and previously hung sections of vent bag duct system was performed for a period prior to the initial 2013 entry. A series of vent bags were connected and hung from the walls of the tunnel using spads. The vent bags were extended to 600 feet into the mine and remain in place for future work.

  - A high volume (10,000 cfs) electric fan was used for ventilation during mine entries. The diesel generator used to power the fan was placed away from the portal to prevent carbon monoxide intake to the fan.

- Removal of in-mine solids retention dams from 2012

  - In-mine solids retention dams (sandbag dams) previously installed to reduce solids discharge during mine entries were removed to improve work safety conditions.

- Water and solids management system installation (See Section 5 and Appendix B for details)

  - A piping system was installed to direct water from the portal pool down the waste rock dump and under CR53 to the settling pond.

  - Chemical feed tanks, pumps, tubing, injection ports, and in-line "mixing" zones were installed in the piping for addition of sodium hydroxide, LBP polymer, and Chitosan flocculant to enhance solids settling in the settling pond.

  - Filtration systems

    - A multi-media / canister filtration system was installed to provide additional solids removal.

    - Filter bags were available as a contingency for when the multi-media filtration system was not used or did not adequately remove solids from the water. This proved unnecessary during the period of operations in 2013.

- Water and solids management system testing and operation (See Section 5 and Appendix B for details)

  - During the entry work and ventilation bag set-up, it became necessary to remove a portion of the solids precipitates to create a channel to walk in while underground. This added to the volume of the solids to manage.

- Testing
    - Preliminary settling tests and pH titrations were performed to estimate chemical requirements and initial chemical feed rates.
    - Field bucket tests were performed to optimize feed rates to enhance solids settling.
- Filter bags (15-foot x 15-foot) were attached to culverts that passed under CR53 to collect sediment if discharged during the work pad improvements and drainage channel clearing efforts.
- Water was directed to the system prior to the start of mine entries each day to charge the system and ensure proper function.
- pH and settling characteristics were monitored and chemical injection rates were adjusted as needed to account for variations in water quality when in-mine work activity changed.
- Water samples were collected from the portal pond and the filter discharge point (see Section 6).
- After the effects of the mine entry ceased each day, water was directed back to the historic flow path down the face of the waste rock dump.
- After the last mine entry for 2013, approximately 800 to 1000 cubic feet of solids were left in the ponds to dry. A solids sample was collected from the bottom of the pond after the water was pumped off (see Section 6).

- Mine assessment
    - The mine was mapped and characterized to a point approximately 980 feet into the mine on the main cross-cut. Two larger drifts were also inspected and mapped, each several hundred feet as shown on Figures 2 and 3. The results are presented in Section 3.1.2.
    - Mine water was sampled from the primary flows from the drifts and along the main cross-cut and samples were sent to a laboratory for analysis (see Section 6).
    - In-mine personnel monitored oxygen and carbon monoxide levels during mine entries.

- Post-assessment cleanup
    - A 25-foot square, 4-foot deep temporary repository was installed at the north end of the base of the waste rock dump east of CR53. The cell was lined with geotextile and spent filtration bags.
    - Solids were removed from the south cell of settling pond and plac ed at the toe of the waste rock dump within a cell constructed for those solids. Solids from the north and central settling pond cells were left in the pond to dry over the winter because the water content was too high for efficient removal.

- Temporary piping used to convey flow to the pond was removed. Any disturbance to the county road was graded and fill was added as needed (September 2013).

3.1.2 2013 Mine Investigation Findings

The following findings resulted from the 2013 mine investigation (DRMS 2014 a [provided in Appendix C] and mine maps). Two maps prepared by personnel conducting the mine entries are presented as Figures 2 (DRMS map) and 3 (Bockstiegel map).

- The Red and Bonita mine workings (main cross-cut and multiple drifts) were mapped. A collapse and precipitation build-up prevented further entry at approximately 980 ft in from the portal on the main eastward heading. Approximately 2000 feet of workings were assessed.

- The portal of the Red and Bonita adit is faced-up in ferricrete, and the adit is then driven through Burns Member rhyodacite of Silverton Volcanics Formation.

- The first major drift occurs at 275 feet into the tunnel, with approximately 40 gpm to 50 gpm flow from the drift into the main tunnel.

- The drift at 275 feet extends to a distance of 940 feet from the portal. A secondary drift at 640 feet from the portal along the 275 drift ends at a caved in area.

- The tunnel splits at 362 feet into the tunnel, with the primary tunnel veering left; the straight segment dead ends and only contains stagnant water (no inflow to main tunnel).

- A stub drift is present 452 feet into the tunnel.

- The main tunnel is timbered between 590 and 650 feet into the tunnel. Some loose rock was observed on the left rib.

- A drift veers left at 764 feet into the tunnel. The drift extends to 1158 feet in from the portal and contributed approximately 20 gpm to the tunnel discharge.

- The main tunnel was evaluated to a point 980 feet in from the portal. The main tunnel past 764 feet contributed approximately 200 gpm to the tunnel discharge.

- A stope and stulls are present in the main adit heading east past 764 feet.

- A collapse that impounds a pool of water is present at 980 feet into the main tunnel. The mine can be accessed beyond this point but wasn't entered during 2013 to prevent uncontrolled release of water from behind the dam and to protect worker health and safety.

- A potential bulkhead location was identified at 265 feet into the tunnel. This location is outby the first primary drift at 275 feet that contributed 40 to 50 gpm of water during the 2013 mine mapping.

3.2 REMOVAL ASSESSMENT - 2014

A packer/hydraulic conductivity test was performed the week of September 8, 2014 to help determine the hydraulic properties of rock at the potential bulkhead location identified by EPA and DRMS during

previous mine entries. Construction work was performed by ER. Water treatment testing and operation was performed by ER and START. Miners from Maisel Construction drilled boreholes for the packer test. The packer test was performed by DRMS, EPA, and START with support by ER.

Work conducted at the site during 2014 included the following:

- A mine water sample was collected from the portal pool and titrated with 25% sodium hydroxide to estimate the amount of sodium hydroxide required to increase the pH to range between 6 and 7. Settling tests were performed to determine the optimum Brennfloc flocculant addition rate.

- Solids left in the settling pond from the 2013 mine entries were removed with shovels and an excavator and placed in the temporary repository. Geotextile disturbed during excavation was repaired. Straw bales and staked silt-fence were used to increase the elevation of the baffles between settling pond cells.

- Packer tests were conducted in each borehole. See Section 4 for more information regarding the packer test and test results.

- The water and solids management system for 2014 included sodium hydroxide addition, free flow down the face of the waste rock dump, pH measurement, flocculant addition, settling in the three cell settling pond, and pumping water from the settling basin to the historic discharge channel. More details regarding the water and solids management system are provided in Section 5.

- Reconnaissance of the mountainside above the Red and Bonita workings was performed by EPA and DRMS. There were no indications of any overlying workings or other features connecting the underground workings to the surface.

4 PACKER TEST

Reconnaissance and mapping of the underground workings of the Red and Bonita mine conducted during 2012 and 2013 identified a location 265 feet in from the mine portal as the ideal location for a water impounding concrete bulkhead. The rock at this location is intensely jointed, and although the joints are tight, it was determined that packer testing to determine the permeability of the joint was a prudent step in the bulkhead feasibility evaluation (DRMS 2014).

4.1 PACKER TEST METHOD

Cumulative packer tests were performed on September 9 and 10, 2014 to evaluate the in situ hydraulic permeability of the shallow rock at the potential bulkhead location. The packer test was conducted by drilling a borehole into the rock, inserting a plug (packer) into the borehole, injecting water behind the plug, and measuring the amount of water needed to maintain a steady pressure. A greater amount of water required indicates greater hydraulic conductivity than if only a small amount of water is required to maintain the pressure. The detailed packer test description, procedure, and equipment list are included in Appendix D. The following work was completed for the 2014 packer test.

1. Two 10.5 foot deep 2.25-inch diameter boreholes were drilled, one on each side of the mine, at 265 feet into the mine and an additional two boreholes were drilled at 275 feet into the mine (Figures 2 and 3).

2. Boreholes were flushed with clean water supplied by pump from a 255 gallon tote located outside of the mine.

3. The packer system was pre-tested outside the mine prior to start of the packer test.

4. The water line (consisting of water tank, pump, hoses, pressure gauges, valves, flow meter and connectors) was set up. The water line was observed for leakage.

5. The air supply (consisting of a pressurized air tank, gauge, hoses, and connectors) was set up.

6. The single packer assembly with open bottom was connected to the water line and air supply.

7. The packer element was inserted 48 to 50 inches into the borehole.

8. The packer gland was slowly inflated to a working pressure of 200 psi to seal the element against the borehole wall. The air supply line was monitored for 2 minutes to ensure the air system was not leaking.

9. Water was injected up to a pressure of 100 psi into the void between the packer element and the terminus of the borehole.

10. The flow rate of water to maintain a pressure of 100 psi was recorded regularly during the test. The test was operated for a minimum of 15 minutes except in the southeast borehole where packer air pressure was lost 6 minutes into the test.

11. Water injection flow rates and pressures were observed until consistent readings were taken to represent steady-state flow.

12. The water line was depressurized, then the air line was de-pressurized, and the packer was removed from the borehole.

13. The test was repeated in the remaining three holes.

14. Due to the positive results (relatively low flow of water required to maintain 100 psi pressure behind the packer), only one test was performed in each borehole. If the initial test had required a significant amount of water to maintain 100 psi, the test would have been repeated with the packer inserted an additional 2 to 4 feet into the borehole.

4.2 PACKER TEST RESULTS

The packer test data and results are shown below. The calculations and conclusions are presented in a DRMS memorandum (DRMS 2014b) that is provided in Appendix C and summarized below.

Location	Distance into Mine	Length of test section (meters)	Radius of Test hole (meters)	Water Consumption (liters)	Test duration (seconds)	Water Pressure (meters of head)	Secondary Permeability Index (SPI) (liters per second per square meter)
Northeast	275 feet	2.13	0.0254	0.051	900	60.09	Relatively Impermeable
Southeast	275 feet	2.13	0.0254	0.4725	360	70.59	Relatively Impermeable
Northwest	265 feet	2.13	0.0254	16.88	900	69.62	1.54×10^{-14}

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Location	Distance into Mine	Length of test section (meters)	Radius of Test hole (meters)	Water Consumption (liters)	Test duration (seconds)	Water Pressure (meters of head)	Secondary Permeability Index (SPI) (liters per second per square meter)
Southwest	265 feet	2.13	0.0254	4.35	900	68.92	4×10^{-15}

The rock encountered at 265 feet and 275 feet into the Red and Bonita Mine is Class A as defined by Azimian (2013). Class A rock is impermeable and the best class of rock that does not need improvement. Based on these results and the proximity of a free rock face to the test locations, formation grouting prior to bulkhead installation will not be necessary.

5 WATER AND SOLIDS MANAGEMENT

Water management was designed to maintain the mine discharge at ambient conditions while mine entry operations were conducted. While some reduction in the dissolved metals was achieved, the primary goal was to remove the suspended solids from the adit. During 2013, the water and solids management system included sodium hydroxide addition in the portal pond, 6-inch piping to carry water from the mine to the settling basin, injection ports for polymer and flocculant addition, a three cell settling basin divided by 2-foot baffles, a multi-media filtration system, and filter bags. Clarified water from the settling basin was pumped to either the filtration system or filter bags. Components of the system are described below and shown on Figure 4.

5.1 WATER AND SOLIDS MANAGEMENT - 2013

The water and solids management system consisted of the following components, starting with discharge from the mine and ending with discharge to the historic flow path to Cement Creek.

1. Water flowed from the mine into the portal pond.

    a. Note: Large volumes of particulates were discharged during mine entries and accumulated in the portal pond, diminishing pond capacity. To correct this, the water was manually agitated to move the solids into the water and solids management system.

2. 25% sodium hydroxide, stored on a flatbed trailer in four 375-gallon totes, was pumped to the downstream end of the portal pond using a chemical injection pump and flexible hose. The initial injection rate was 1.25 liters per minute (L/min), but the caustic addition rate was adjusted as needed to maintain pH greater than 5.5. A generator was used to power the sodium hydroxide pump. When the pump was inadequate to increase pH above 5.5, sodium hydroxide was added manually using 1-gallon jugs. A 55-gallon barrel of potable water was configured as an emergency shower in the event of sodium hydroxide exposure.

3. A 14-inch PVC pipe transported water to the top edge of waste rock dump. A pipe reducer with a 6-inch manifold was used to direct water either into a 6-inch piping system or down the face of the waste rock dump. During mine entries, water was directed into the piping system. After mine water clarified at the end of the day, water was directed down the face of the waste rock dump and into the historic flow path to Cement Creek.

4. A port for the pH meter was installed in the manifold. pH was monitored with a Horiba water quality meter that was calibrated daily.

5. 6-inch aluminum piping carried water from the top of the waste rock dump to a small crosscut road near the bottom of the waste rock dump. Aluminum piping was used on the steepest slopes due to its strength, light weight, and ease of assembly. The aluminum pipe was connected to 6-inch PVC pipe at the crosscut road.

6. LBP polymer, stored in a 330-gallon tank on the crosscut road, was pumped to the water via tubing into an injection port in the PVC pipe. The initial injection rate was 0.11 L/min but the rate was adjusted as needed to enhance settling in the downstream settling pond. A generator was used to power the LBP polymer pump. The LBP polymer significantly increased the efficiency of the Chitosan flocculant, reducing settling time and increasing water clarity

7. 6-inch PVC piping was routed in a serpentine pattern to enhance mixing of the polymer and slow the water. The serpentine sections were made by connecting 18-inch pipe segments using right angle joints.

8. Two 6900-gallon emergency storage tanks (approximately 45 minutes of water inflow at 300 gpm) were staged on a platform at the north end of the waste rock dump base. The tanks were plumbed into the 6-inch piping system via a two valve Y manifold. The backup tanks may have provided storage for the discharge from the mine in the event of equipment failure and storage capacity in the pond was exceeded. The emergency storage tanks were not used.

9. Chitosan flocculant, stored in a 330-gallon tank at the north base of the waste rock dump, was pumped with a chemical injection pump through tubing into an injection port. Chitosan flocculant was used because it is a naturally biodegradable material that freely binds with the sludge and is completely retained with the sludge in the multi-media filtration system without clogging. The initial addition rate of 0.063 L/min was varied as needed to enhance settling in the downstream settling pond. A generator was used to power the pump.

    a. High altitude, cold temperatures and the high viscosity of the Chitosan flocculant caused problems for the chemical injection pump, the pump rate slowed even more when the flocculant was cold. The flocculant was diluted with water to make a 50% solution that was less viscous than pure flocculant.

10. Water was piped to the settling pond via 6-inch PVC piping.

    a. Straight pipe to the ditch adjacent to CR53 at the base of the waste rock dump

    b. Serpentine pipe then straight PVC pipe in the ditch (see item #6)

    c. Pipe under CR53 to the settling pond

11. Water flowed through a 6-inch flexible hose and a float mounted diffuser into the north end of the settling pond. The diffuser was used to aerate the water, prevent flowing water from damaging the pond, and enhance mixing of flocculant and polymer.

12. A settling pond (90 feet by 45 feet at the top of the berm and 33 feet by 45 feet at the toe of the berm with two three-foot high baffles) was used for solids settling (Figure 5). Solids settled to the bottom leaving a layer of clear water on the surface. The pond with free-board was designed to

hold about 6 hours of mine water inflow based on an estimated inflow rate of 300 gpm; however, the pond was operated at less than the calculated volume (water was pumped from the pond prior to reaching the full design depth). The pond was lined with geotextile fabric.

a. Note: Solids removal in the pond system was difficult due to the steep slopes and the presence of the geotextile. Positioning the pond for easier access would be helpful for future events.

b. The baffles were intended to be underwater; however, settling was greatly improved when the settling pond was operated as a 3 cell unit. Increasing the elevation of the baffles would improve settling.

13. Clarified water from the southern end of the settling pond was pumped through a floating strainer and 4-inch flexible hose connected to a 820 gpm, 4 inch diameter diesel powered water pump with a 4-inch flexible hose. Water was pumped to the multi-media filtration system during the mine entry operations. As final pond decanting occurred the water was pumped through filter bags.

    a. A 450 gpm 3-inch diesel powered water pump was available to provide redundancy in the event the 4-inch pump failed. A two valve manifold was positioned between the pond and the pumps so that either pump could draw water from the pond as needed.

    b. A three valve manifold diverted the water to the multi-media filtration system, filter bags, or the historic discharge path to Cement Creek.

14. Water was pumped to a two-stage multi-media filtration system. The first stage was a 1000 gpm series of four stainless steel tanks containing 19 cubic feet of sand and gravel. The second stage consisted of bridged 400 and 1000 gpm stainless steel tanks containing multiple 10 micron size filter bags. The resulting water was as clear or clearer than undisturbed adit discharge.

15. A backup filtration system was connected to the three valve manifold previously described. 4-inch flexible hose was linked between the three valve manifold to a four valve 6 inch PVC manifold which individually controlled water flow to four backup Dandy Dewatering Bags™ . The backup system provided redundancy in the event of an emergency shutdown of the primary system but was not activated during this project.

16. Discharge to historic flow path to Cement Creek

5.2 WATER AND SOLIDS MANAGEMENT - 2014

The following system was used to collect solids during 2014 mine entries.

1. Sodium hydroxide, contained in a 375 gallon tote, was gravity fed to the downstream end of the portal pond. The initial addition rate of 1.25 L/minute was adjusted based on pH readings at the base of the waste rock dump.

    a. Note: It is important to maintain flexibility in chemical addition rates due to the high variability in pH and solids content of water discharged during mine entries.

    b. The pumps used for chemical injection during 2013 mine entries were not reliable in providing a safe, consistent flow of sodium hydroxide . Peristaltic pumps would be more

effective for chemical addition and should be able to achieve adequate flow if multiple units are available for peak feed rates.

2. Water flowed down the northern face of the waste rock dump. Sandbags were placed to direct flow to the northernmost section of the typical flow path.

3. pH was measured with a Horiba water quality meter placed in the active flow path near the base of the waste rock dump immediately upstream of the flocculant addition point. The target pH was 7, with a tolerance from 5.5 to 8. The initial sodium hydroxide addition rate was 0.3 L/min, but the rate was adjusted as needed to achieve the target pH. It was noted that when pH increased to 10 or greater, the water got a greenish tinge.

4. Brennfloc, dissolved in water at a concentration of approximately 1 gram/liter, was gravity fed via a 2-inch hose from a 375 gallon plastic tote to the active flow path at the base of the waste rock dump. The initial feed rate was 1 L/min, but flow was adjusted as needed to achieve settling in the settling pond. When full flow gravity feed was not adequate to achieve settling, solid Brennfloc was added in the ditch on the east side of CR53.

    a. Note: While Brennfloc dissolved in water was most effective in settling water during cone and bucket tests, addition of particulate Brennfloc promoted better settling during full scale operation. It would be helpful to find a mechanized means to add particulate Brennfloc, a fine granular material.

5. Water flowed south in the ditch along the east side of CR53, the typical flow path, to a headgate made of plywood that directed water into a 12-inch PVC pipe that crossed under CR53 to the settling pond. [When the system was not being operated, the headgate was opened and water flowed in the typical flow path toward Cement Creek.]

6. Water flowed through the pipe into the north cell of the settling pond. The settling pond was the same as was used during 2013; however, the baffles were elevated using a combination of hay bales and staked geofabric.

    a. Note: Water flowed directly from the 12-inch pipe into the pond. Use of a diffuser or other means to reduce the velocity of water entering the pond would allow more effective settling.

    b. Note: The staked geofabric was somewhat effective in raising the effective height of the baffles. The hay bales were more effective in raising the effective height of the baffles.

    c. Note: Increasing the effective height of the baffles and creating weirs to cause serpentine flow in the settling pond would improve settling.

7. Water was pumped from the southern cell of the settling pond and discharged along the histori c flow path for Red and Bonita Mine discharge.

8. Settling pond system discharges were periodically monitored for pH, conductivity, and turbidity.

9. Filter bags were available for additional filtration; however, when the turbidity of discharge from the filter bags was not significantly less than that pumped directly from the southern cell of the settling pond, the use of filter bags was discontinued.

10. At the end of the day when water in the mine was not being disturbed, the pH leveled at approximately 6 and water flowing down the waste rock dump face appeared clear.

6 SAMPLING AND ANALYSIS

6.1 SAMPLE COLLECTION

Five surface water samples plus one duplicate sample were collected from outside the mine during 2013 and submitted for total and dissolved metals analysis at the EPA Laboratory in Golden, Colorado. Surface water sample locations are shown on Figure 6.

- RBSW01_08072013 was collected from the pool outside the mine portal (portal pool) before any mine work began in order to provide baseline data for future comparison. This site is known as CC-03C in site-wide monitoring efforts.

- RBSW02_080913 and RBSW02_08142013 were collected from the multi-media filtration discharge point to represent post-filtration water quality.

- RBSW03_08072013 was collected from Cement Creek downstream of the Red and Bonita inflow prior to mine entry.

- RBSW03_08142013 was collected from the adit pool (CC-03C) approximately 3 hours after the completion of the last 2013 mine entry to represent post-entry mine discharge water quality and for comparison to the baseline sample.

- Sample RBSW99_080913 was collected as a duplicate of sample RBSW02_080913.

Due to a delay in filtration and preservation, the dissolved metals analytical result s from samples collected on August 7 and August 9 should be interpreted with caution.

Three mine water samples were collected by from the Red and Bonita Mine during the 2013 mine entry. Mine water sample locations are shown on Figure 3.

- RBMW01_08132013 was collected 275 feet into the mine from a drift to the right flowing at approximately 40 gpm.

- RBMW02_08132013 was collected 764 feet into the mine from a stope in the main channel flowing at approximately 200 gpm.

- RBMW03_08132013 was collected 764 feet into the mine from a channel entering from the left flowing at approximately 20 gpm.

One solid sample (RB071913-SO01) was collected from the base of the settling pond prior to use of the pond during 2013. This sample represents the total metals concentrations in the solids discharged during 2012 site activities.

Water samples were not collected during 2014. Settling pond solids were collected in a 5-gallon bucket after the first day of settling pond operations, covered with geotextile, and placed under a tree south of the waste rock dump. The sample will be used to assist in determining the best means of handling and disposing solids left in the ponds after the 2014 mine entry efforts.

6.2 SAMPLE RESULTS AND DISCUSSION

The total and dissolved metals concentrations for the portal pool and settling system effluent sample are shown on Table 2. The total and dissolved metals concentrations for the in-mine samples and the portal pool are shown on Table 3. The portal pool samples are shown on both tables for ease of comparison. The total metals analytical results for the pond solids sample are provided in Table 4. A comparison of duplicate samples is shown on Table 5.

6.2.1 Portal Pool Before and After Mine Entries

Comparison of the two samples collected from the portal pool before and after mine entries indicates that there was a slight increase in the concentration of total metal analytes after the entries were complete. This may be due to collecting the post-entry sample only three hours after the last entry and the residual presence of suspended solids from the mine entry. Dissolved metals concentrations were not compared due to delayed filtration and preservation of the dissolved metals samples collected on August 7 and 9.

6.2.2 In-Mine Water Analytical Results

The total and dissolved metals analytical results for samples collected inside the mine and immediately outside the mine were compared.

- The sample collected from 744 foot drift to the left (20 gpm) had lower total and dissolved aluminum, dissolved iron, and total and dissolved zinc concentrations compared to the other in-mine samples and samples collected at the portal.

- The samples from the drift 275 feet into the mine, with flow approximately 40 gpm, had higher aluminum and cadmium concentrations than the other samples.

The load of contaminants from each source was calculated assuming flows shown on Table 3, where load is the mass of contaminant discharged per day (concentration times flow).

	2+75 drift to right		7+64 Main		7+64 drift to left	
	Flow (gpm)	**% of Total Flow**	**Flow (gpm)**	**% of Total Flow**	**Flow (gpm)**	**% of Total Flow**
	40	15%	200	77%	20	8%
	Load (pounds/day)	**Percent of Total Load**	**Load (pounds/day)**	**Percent of Total Load**	**Load (pounds/day)**	**Percent of Total Load**
Cadmium	0.044	45%	0.049	50%	0.0048	5
Iron	21.5	10%	180	88%	4.01	2
Zinc	8.4	17%	40.6	80%	1.52	3

The relative load from a source indicates the importance of that source. While the drift 275 feet into the mine represents only 15% of the flow, it represents 45% of the cadmium load and 17% of the zinc load in the mine discharge. The significant contaminant contributions from the drift at 275 feet show the importance of placing the bulkhead where it will contain water from that source.

6.2.3 Water and Solids Management System Discharge Water Results

Two water samples were collected from the water and solids management system discharge, one on August 9 and one on August 14, 2013 (Table 2). Total metal concentrations of metals were similar to or lower on August 14 than on August 9.

Total metals concentrations in the treatment system discharge samples were compared against concentrations in the portal pool samples. Most metal concentrations were similar in the portal pool and the treatment system discharge, but total aluminum and iron were lower in the post-filtration samples. The total sodium concentration was higher in the post-filtration samples.

The sample results indicate the system was effective in minimizing the impacts from mine entries.

6.2.4 Solids Sample Results

Metal concentrations in the solids left in the settling pond from 2012 efforts (Table 4) can be compared to the TCLP sample results from 2012 (Table 1).

6.2.5 Duplicate Sample Results

The duplicate results were compared using relative percent difference (RPD) (Table 5). The RPD ranged from 0 to 10.6%, well within the limits established in the Sampling and Analysis Plan.

7 REFERENCES

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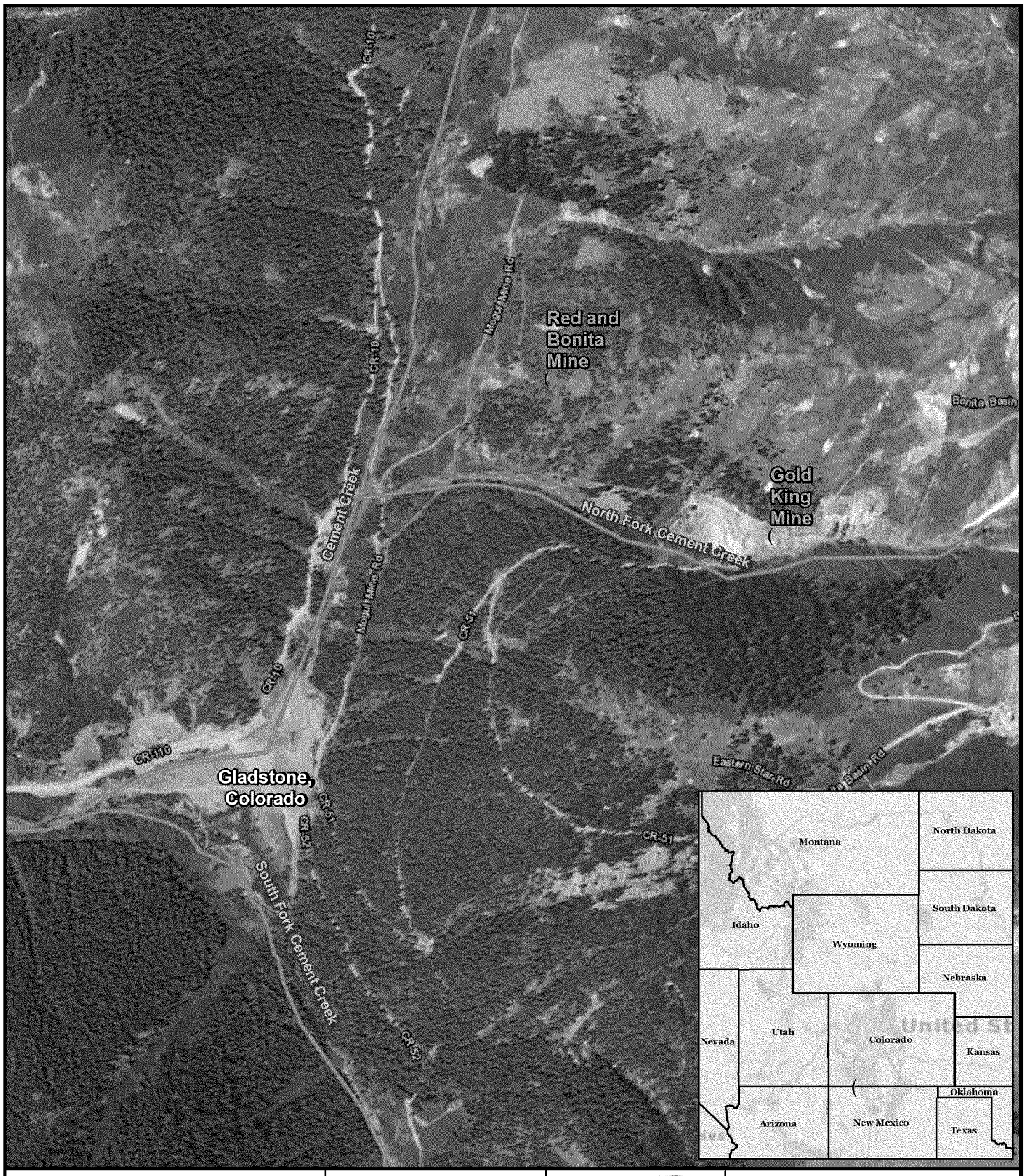
URS Operating Services, Inc. (UOS). 2012b. Field Activities Report, Mine Entry, Red and Bonita Mine Site, Silverton, San Juan County, Colorado. December 14, 2012.

FIGURES



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Mine Locations

Rivers and Streams

0 0.075 0.15 0.3 Miles

Prepared for:
U.S. EPA Region 8

Contract No.:
EP-S8-13-01

TDD:
1306-05 and 1408-01

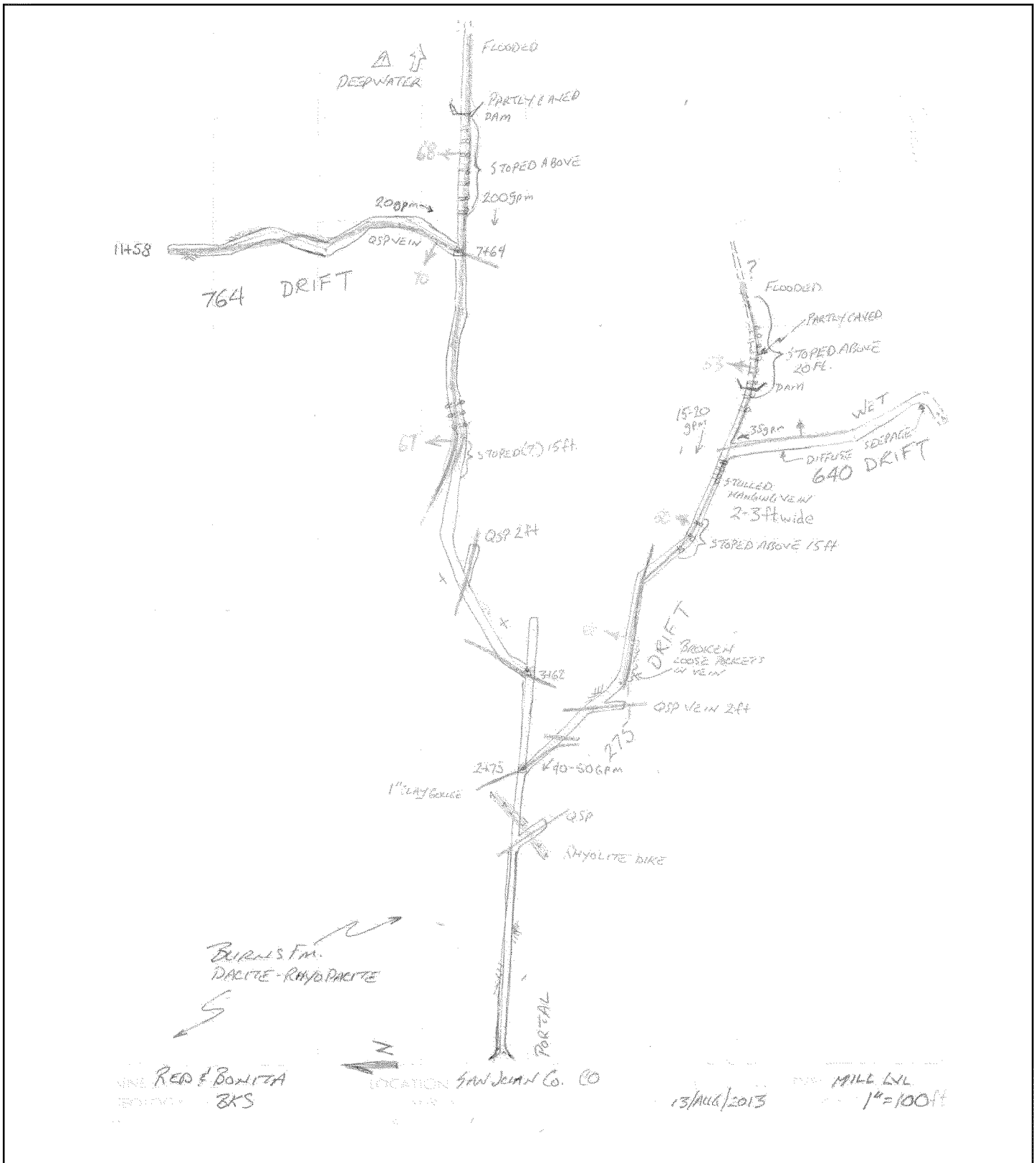
TO:
0001

Prepared By:
Weston Solutions, Inc.
START IV

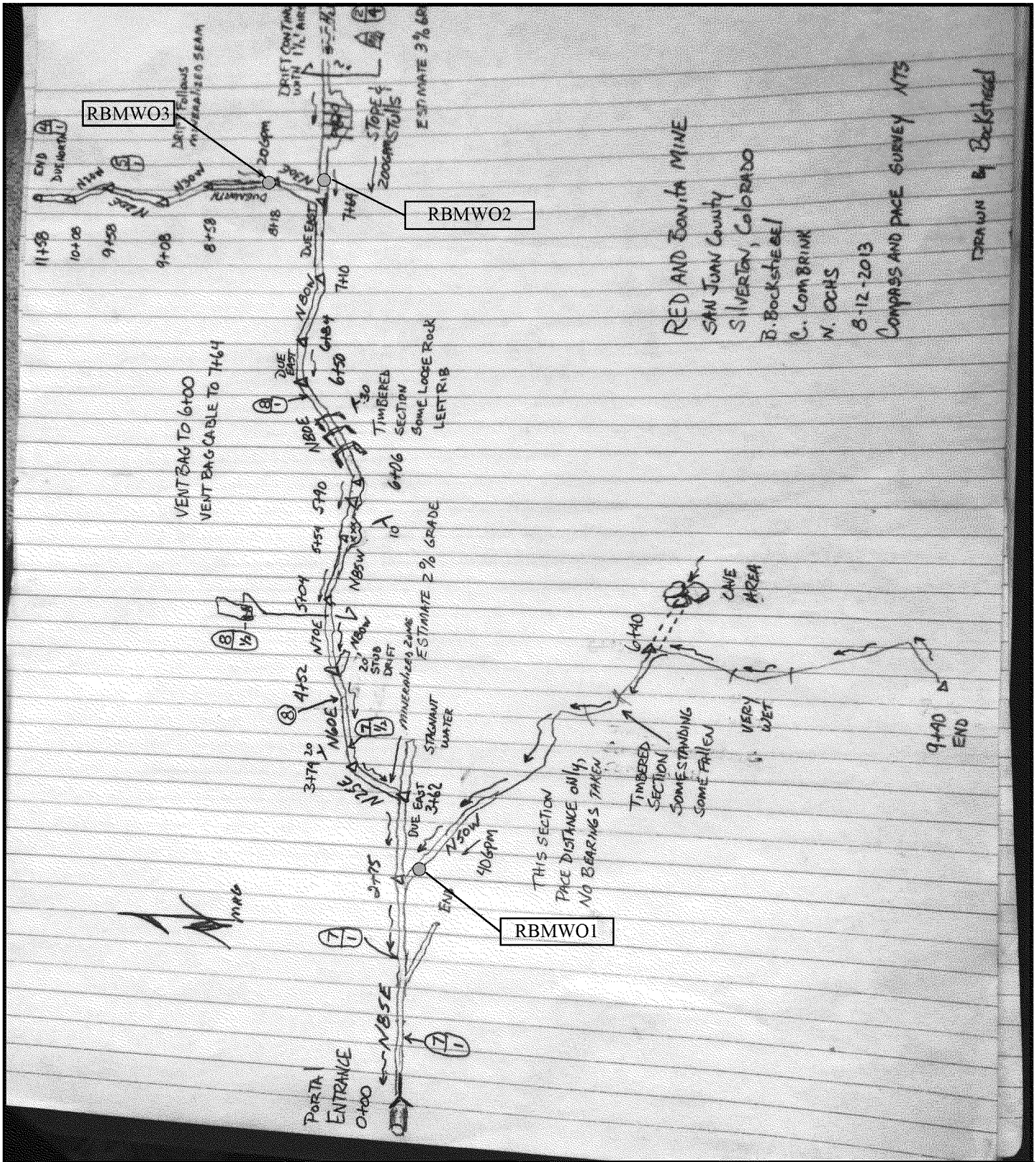
Suite 100
1435 Garrison Street
Lakewood, CO 80215

FIGURE 1
SITE VICINITY MAP
GOLD KING MINE
RED AND BONITA MINE
SAN JUAN COUNTY, COLORADO

Date: 9/5/2014



Sketch of mine workings provided by Colorado Division of Reclamation and Mining Safety N	Prepared for: US EPA Region 8 Contract: EP-S8-13-01 TDD: 0001/1306-05 DCN: W0023.1E.00025	Prepared by: Weston Solutions, Inc. START IV Suite 100 1435 Garrison Street Lakewood, CO 80215	**FIGURE 2** **RED AND BONITA MINE MAP – DRMS** **RED AND BONITA MINE** **COLORADO** Date 11/17/2014



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Sample Locations

N

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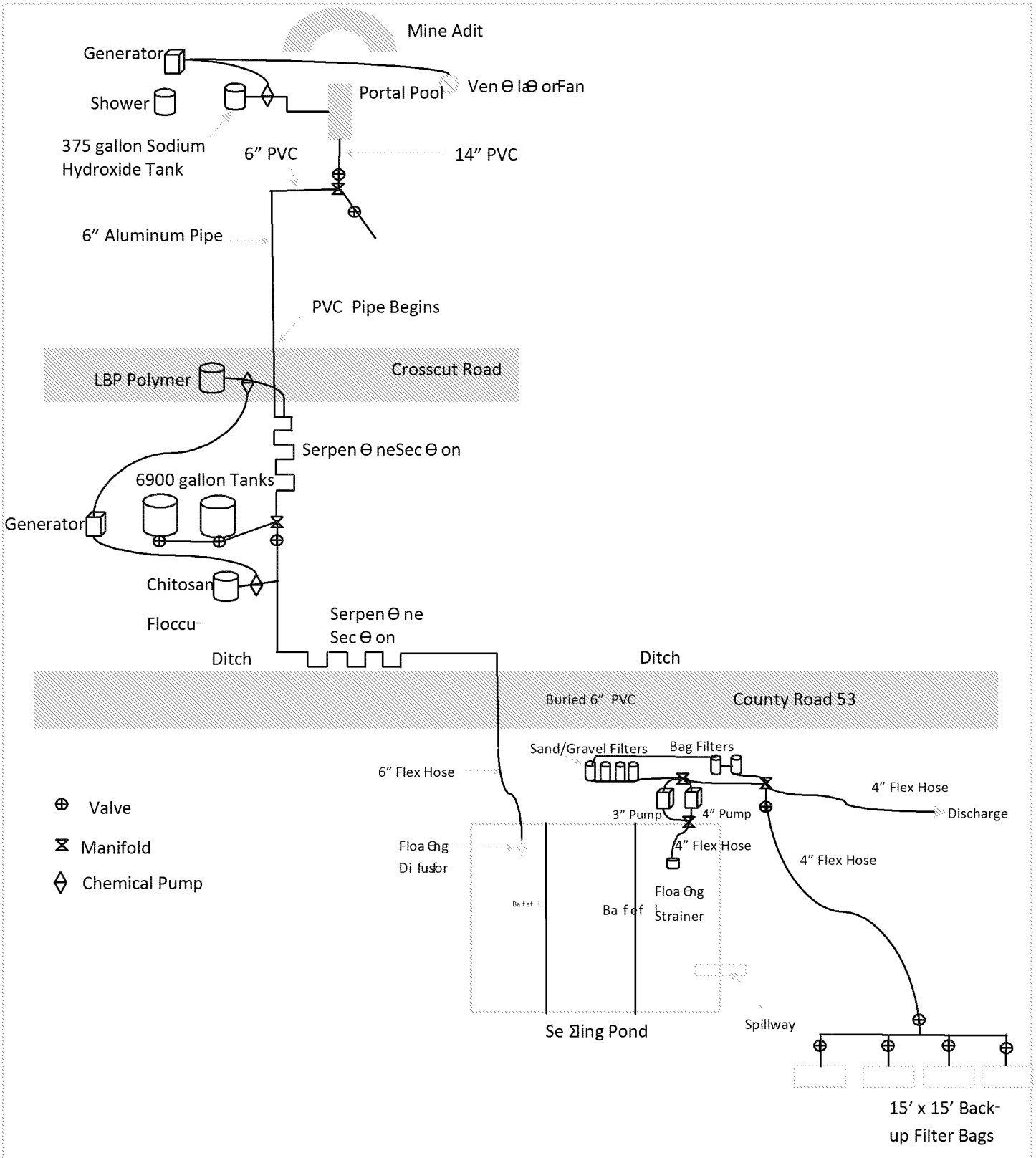
FIGURE 3
RED AND BONITA MINE MAP - BOCKSTIEGEL and MINE SAMPLE LOCATION MAP
RED AND BONITA MINE
COLORADO



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Not to scale

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US EPA Region 8

Contract:
EP-S8-13-01

TDD: 0001/1306-05

DCN: W0023.1A.00335

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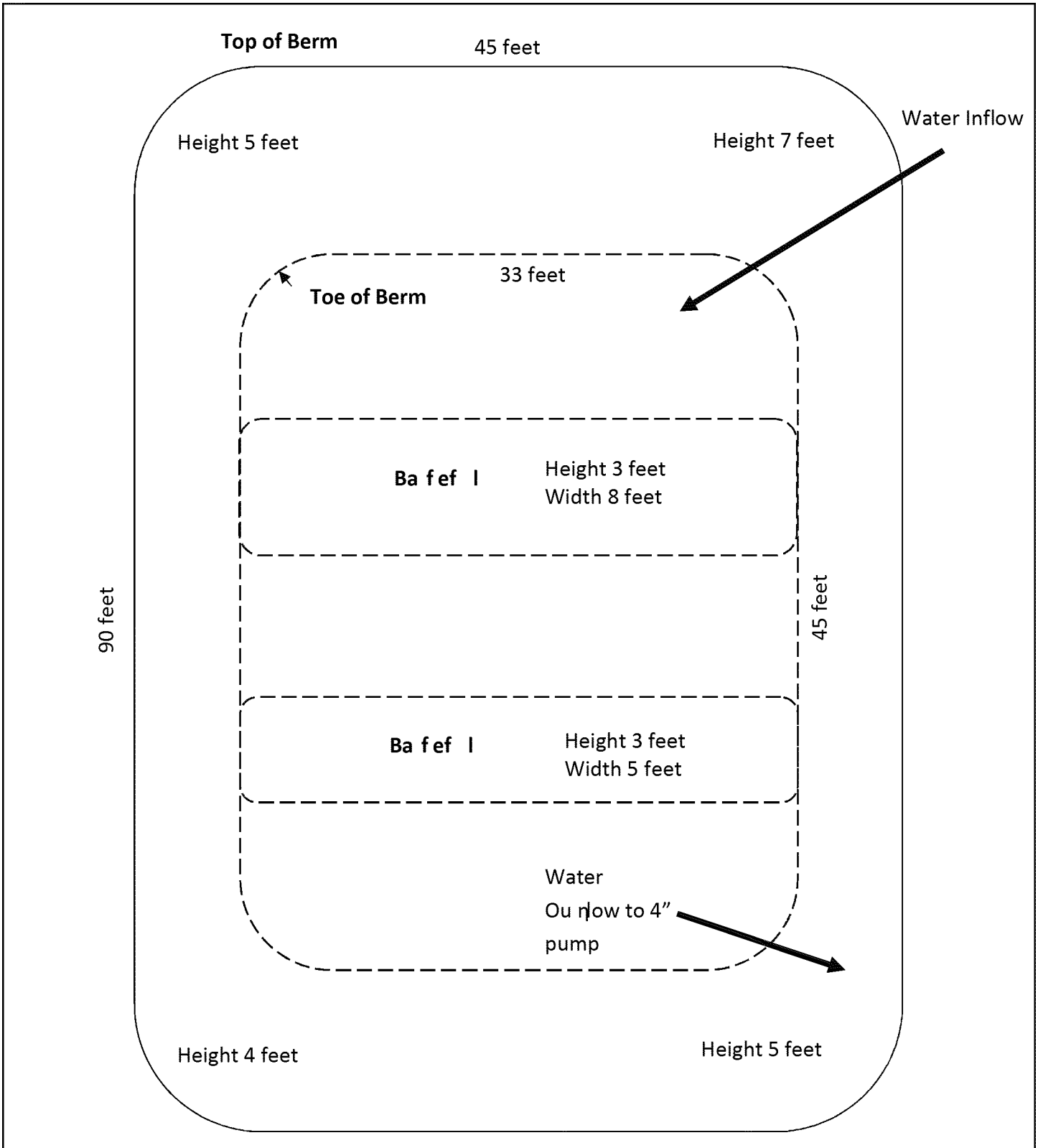
FIGURE 4
2013 WATER AND SOLIDS MANAGEMENT SETUP
RED AND BONITA MINE
COLORADO

Date 11/17/2014



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Not to scale

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Contract:
EP-S8-13-01

TDD: 0001/1306-05

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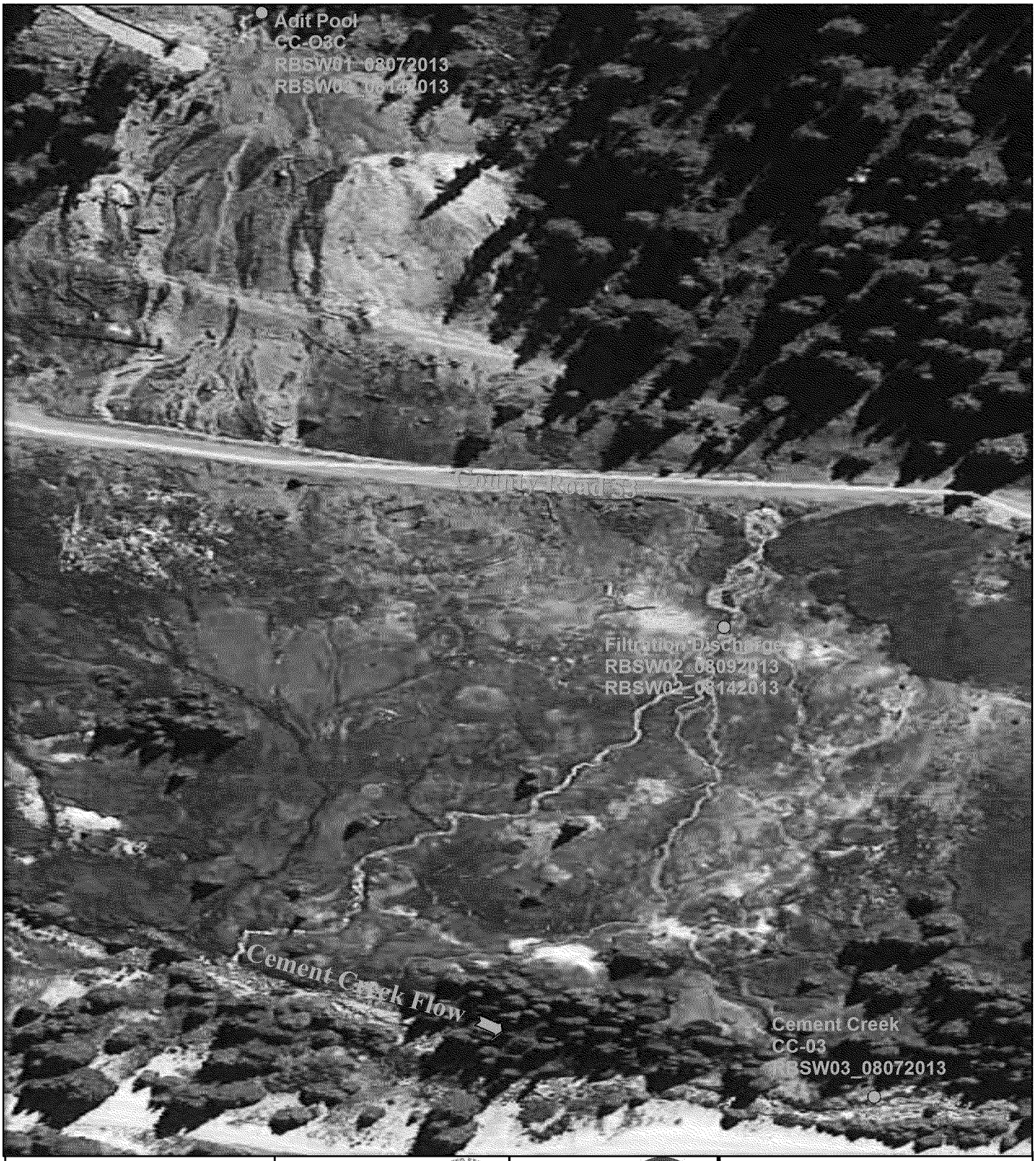
FIGURE 5
SETTLING POND
RED AND BONITA MINE
COLORADO

Date 11/17/2014



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Water Sample Locations

N

Prepared for:
US EPA Region 8

Contract: EP-S8-13-01

TDD: 0001/1306-05

DCN: W0023.1A.00335

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FIGURE 6
SAMPLE LOCATION MAP
RED AND BONITA MINE
COLORADO

Date 11/17/2014

TABLES

TABLE 1
2012 Toxicity Characteristic Leaching Procedure (TCLP) Analytical Results

Analyte	Concentration (mg/L)	RCRA Limit (mg/L)
Arsenic	0.004	5
Barium	0.067 U	100
Cadmium	0.0311	1
Chromium	0.004 U	5
Lead	0.118	5
Mercury	0.0000830	0.2
Selenium	0.0103	1
Silver	0.002 U	5

mg/L milligrams per liter
Limits from 40 CFR 261.24
Analytical results from CompuChem as reported in UOS 2012b.

TABLE 2
Surface Water Analytical Results

	RBSW01_08072013		RBSW02_08092013		RBSW02_08142013		RBSW03_08072013		RBSW03_08142013	
	Portal Pool Prior to Mine Entries		Filtration Discharge		Filtration Discharge		Cement Creek Downstream of Red and Bonita Inflow		Portal Pool 3 Hours after Final Mine Entry	
	8/7/2013		8/9/2013		8/14/2013		8/7/2013		8/14/2013	
Analyte	Dissolved* (µg/L)	Total (µg/L)	Dissolved* (µg/L)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Dissolved* (µg/L)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)
Aluminum	4840 D	5950 D	2220 D	2260 D	371 JD	429 JD	3130 D	2800 D	3940 D	4420 D
Antimony	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U
Arsenic	1000 UJ	1000 U	1000 UJ	1000 U	1000 UJ	1000 U	1000 UJ	1000 U	1000 UJ	1000 U
Barium	50 U	50 U	50 U	50 U	50 U	50 U	20 JD	21 JD	50 U	50 U
Beryllium	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Cadmium	30.5 JD	31.3 JD	39.6 JD	37.7 JD	24.2 JD	21 JD	60 U	60 U	31.3 JD	31.6 JD
Calcium	425000 D	417000 D	422000 D	419000 D	427000 D	417000 D	129000 D	130000 D	417000 D	427000 D
Chromium	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Cobalt	119 D	108 D	114 D	107 D	83.7 D	90.6 D	27.4 JD	24.8 JD	110 D	107 D
Copper	50.4 D	76.5 D	37.6 D	34 D	30 U	30 U	140 D	144 D	30 U	43.7 D
Hardness	1170 D	--	1160 D	--	1170 D	--	365 D	--	1150 D	--
Iron	90400 D	93300 D	63200 D	61500 D	38000 D	40600 D	15500 D	15700 D	55600 D	103000 D
Lead	131 JD	290 D	250 U	250 U	250 U	250 U	250 U	250 U	250 U	250 U
Magnesium	26000 D	26000 D	25800 D	25900 D	25900 D	25600 D	10100 D	9970 D	25700 D	26300 D
Manganese	33600 D	33300 D	32300 D	32200 D	32000 D	31500 D	9140 D	8950 D	33200 D	34200 D
Mercury	NA	0.2 U	NA	0.2 U	NA	0.2 U	NA	0.2 U	NA	0.2 U
Molybdenum	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U
Nickel	84.6 JD	73 JD	82.4 JD	67.8 JD	58.8 JD	57.9 JD	100 U	100 U	72.3 JD	70 JD
Potassium	10000 U	10000 U	10000 U	10000 U	10000 U	10000 U	10000 U	10000 U	10000 U	10000 U
Selenium	1000 U	917 JD	1000 U	1000 U	610 JD	1000 U	1000 U	1000 U	1000 U	754 JD
Silver	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U
Sodium	7980 JD	8170 JD	57200 D	58200 D	79000 D	78600 D	3030 JD	3000 JD	8040 JD	8220 JD
Strontium	4850 D	4870 D	4740 D	4730 D	4820 D	4780 D	1350 D	1340 D	4820 D	4930 D
Thallium	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U
Vanadium	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U
Zinc	16000 D	15900 D	15600 D	15300 D	8740 D	8600 D	5590 D	5430 D	15600 D	16200 D

J	The reported value was obtained from a reading that was less than the contract required quantitation limit but greater than or equal to the method detection limit.
U	The analyte was not detected at the method detection limit
D	The reported value is from a dilution
NA	Not Applicable
µg/L	micrograms per liter
gpm	gallons per minute
*	The analytical results for dissolved samples collected on August 7 and 9, 2013 should be used cautiously due to a filtration/preservation error.

TABLE 3
Mine Water Analytical Results

Analyte	RBMW01_08132013		RBMW02_08132013		RBMW03_08132013		RBSW01_08072013	
	2+75 Drift to Right (40 gpm)		7+64 Stope (200 gpm)		7+64 Drift to left (20 gpm)		Portal Pool before Mine Entries	
	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Dissolved (µg/L)
Aluminum	11,400 D	11,100 D	3760 D	3430 D	399 JD	410 JD	5950 D	4840 D
Antimony	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U
Arsenic	600 U	600 UJ	600 U	600 UJ	600 U	600 UJ	600 U	600 UJ
Barium	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Beryllium	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Cadmium	91.6 D	92 D	20 U	20.6 JD	20 U	20 U	31.3 JD	30.5 JD
Calcium	478,000 D	478,000 D	446,000 D	437,000 D	329,000 D	324,000 D	417,000 D	425,000 D
Chromium	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Cobalt	126 D	131 D	113 D	120 D	62.7 D	67 D	108 D	119 D
Copper	33.7 D	30.1 D	20 U	20 U	21.3 JD	20 U	76.5 D	50.4 D
Iron	87,100 D	44,700 D	98,700 D	75,000 D	72,800 D	16,700 D	93,300 D	90,400 D
Lead	100 U	100 U	100 U	100 U	100 U	100 U	290 D	131 JD
Magnesium	32,600 D	32400 D	25700 D	25200 D	26300 D	25800 D	26000 D	26000 D
Manganese	28,400 D	28400 D	35400 D	35000 D	32300 D	31700 D	33300 D	33600 D
Mercury	0.1 U	NA	0.1 U	NA	0.1 U	NA	0.1 U	100 U
Molybdenum	107 JD	100 U	100 U	100 U	100 U	100 U	100 U	100 U
Nickel	89 JD	110 D	79 JD	77.7 JD	50 U	50 U	73 JD	84.6 JD
Potassium	2500 U	2500 U	2760 JD	2500 U	2500 U	2500 U	2500 U	2500 U
Selenium	600 U	600 U	600 U	600 U	600 U	600 U	917 JD	600 U
Silver	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Sodium	9550 JD	9380 JD	7920 JD	7680 JD	10300 D	9970 JD	8170 JD	7980 JD
Strontium	5550 D	5540 D	5160 D	5040 D	3550 D	3490 D	4870 D	4850 D
Thallium	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U
Vanadium	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U
Zinc	17,500 D	17,400 D	17,100 D	16,900 D	6520 D	6350 D	15,900 D	16,000 D

J The reported value was obtained from a reading that was less than the contract required quantitation limit but greater than or equal to the method detection limit.
U The analyte was not detected at the method detection limit

D	The reported value is from a dilution
NA	Not Applicable
µg/L	micrograms per liter
gpm	gallons per minute

TABLE 4
Total Metals Analytical Results - Settling Pond Solids

Sample ID	RB071913-SO01	
Sample Date	7/19/2013	
Analyte	Chemical Abstract System Number	Concentration (mg/kg)
Aluminum	7429-90-5	3280
Antimony	7440-36-0	100 U
Arsenic	7440-38-2	67.1 J
Barium	7440-39-3	12.2
Beryllium	7440-41-7	5 U
Cadmium	7440-43-9	3.21 J
Calcium	7440-70-2	2630
Chromium	7440-47-3	5 U
Cobalt	7440-48-4	5 U
Copper	7440-50-8	282
Iron	7439-89-6	110,000
Lead	7439-92-1	787
Magnesium	7439-95-4	339
Manganese	7439-96-5	195
Molybdenum	7439-98-7	20 U
Nickel	7440-02-0	10 U
Potassium	7440-09-7	411
Selenium	7782-49-2	100 U
Silver	7440-22-4	11
Sodium	7440-23-5	1000 U
Strontium	7440-24-6	28.6
Thallium	7440-28-0	50 U
Vanadium	7440-62-2	16.4
Zinc	7440-66-6	1520

J The reported value was obtained from a reading that was less than the contract required quantitation limit but greater than or equal to the method detection limit.
U The analyte was not detected at the method detection limit
mg/kg milligrams per kilogram dry weight

TABLE 5
Duplicate Sample Results

	RBSW02_08092013 Dissolved (µg/L)	RBSW99_08092013 Dissolved (µg/L)	Relative Percent Difference	RBSW02_08092013 Total (µg/L)	RBSW99_08092013 Total (µg/L)	Relative Percent Difference
Aluminum	2220	2240	0.9%	2260	2220	1.8%
Antimony	1000 U	1000 U	--	1000 U	1000 U	--
Arsenic	1000 UJ	1000 UJ	--	1000 U	1000 U	--
Barium	50 U	50 U	--	50 U	50 U	--
Beryllium	50 U	50 U	--	50 U	50 U	--
Cadmium	39.6	37.1	6.5%	37.7	35.5	6.0%
Calcium	422000	414000	1.9%	419000	417000	0.5%
Chromium	50 U	50 U	--	50 U	50 U	--
Cobalt	114	107	6.3%	107	114	6.3%
Copper	37.6	41.8	10.6%	34	34.6	1.7%
Hardness	1160	1140	1.7%	NA	NA	--
Iron	63200	60200	4.9%	61500	60400	1.8%
Lead	250 U	250 U	--	250 U	250 U	--
Magnesium	25800	25700	0.4%	25900	25900	0
Manganese	32300	31800	1.6%	32200	32200	0
Mercury	NA	NA	--	0.2 U	0.2 U	--
Molybdenum	200 U	200 U	--	200 U	200 U	--
Nickel	82.4	80.4	2.5%	67.8	65	4.2%
Potassium	10000 U	10000 U	--	10000 U	10000 U	--
Selenium	1000 U	704	--	1000 U	1000 U	--
Silver	100 U	100 U	--	100 U	100 U	--
Sodium	57200	57300	0.2%	58200	58200	0.0%
Strontium	4740	4700	0.8%	4730	4780	1.1%
Thallium	500 U	500 U	--	500 U	500 U	--
Vanadium	500 U	500 U	--	500 U	500 U	--
Zinc	15600	15400	1.3%	15300	15200	0.7%

J The reported value was obtained from a reading that was less than the contract required quantitation limit but greater than or equal to the method detection limit.
U The analyte was not detected at the method detection limit
D The reported value is from a dilution
NA Not Applicable
µg/L micrograms per liter
RPD Relative percent difference (C1-C2)/[(C1+C2)/2]*100%

APPENDIX A
PHOTOGRAPHIC DOCUMENTATION

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Photo Log

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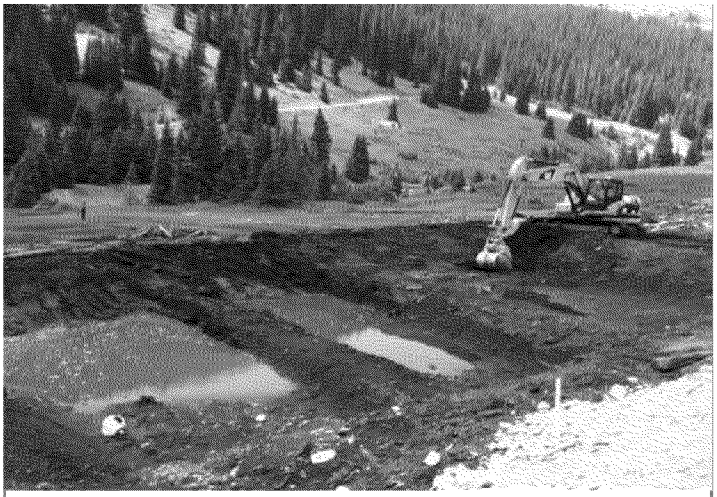
0001-1306-05 EP-S8-13-01	**EPA Region 8 Start Contract** Red and Bonita Mine	July 2013	**1**

DAILY PHOTO LOG

Photo 1

View of settling pond being constructed along CR53, water is from recent rainfall.

Photo 2



Second view of pond construction, note baffles that separate the cells and are intended to slow the flow of water through the pond.

Photo 3

View of completed settling pond with geotextile fabric cover. Purpose of cover is to minimize damage to soil surface and allow recovery of the retained sludge when the project is complete.

Photo 4

View of constructed pad adjacent to CR53 and the settling pond. The pad was used to support the multi-media filtration system and pumps.

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DAILY PHOTO LOG

Photo 5

View of Red & Bonita mine adit and pool prior to reconstruction.

Photo 6

Second view showing the remainder of the adit pool.

Photo 7

View of ERRS beginning reconstruction of the adit pool, debris being removed from the pool.

Photo 8

View of ERRS crew re-routing and draining mine water through diversion in order to remove and re-position 14-inch PVC pipe to drain the adit pool.

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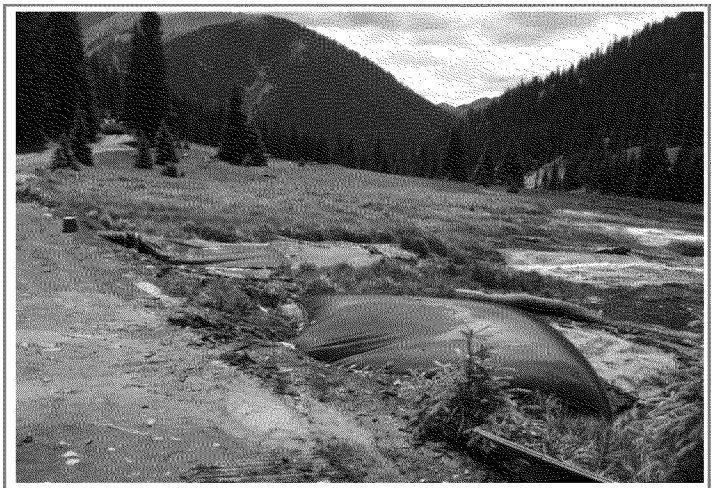
0001-1306-05 EP-S8-13-01	**EPA Region 8 Start Contract** Red and Bonita Mine	July 2013	**3**

DAILY PHOTO LOG

Photo 9



View of 15" x 15" filter bags placed over culverts along CR 10. When adit pool work was being conducted during this time it generated sludge laden water which was captured here prior to discharge to the Cement creek.

Photo 10

View of diversion constructed at adit to route water through alternative piping so that the 14 inch PVC pipe could be positioned in foreground area.

Photo 11

View of diversion trench with plastic liner and 8 inch flex pipe. The diversion was left in place in the event the 14 inch PVC pipe needed maintenance.

Photo 12

View of ERRS removing the existing adit pool drain pipe. The 14 inch PVC pipe is staged above the pool to the left.

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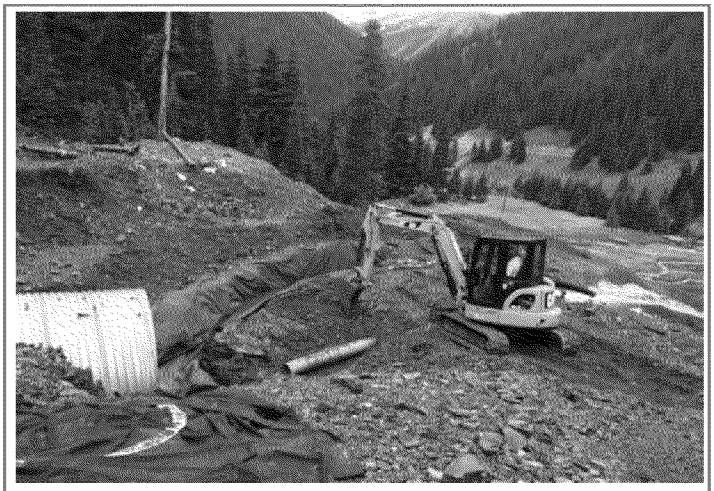
DAILY PHOTO LOG

Photo 13



View of the 14 inch PVC pipe in place and being covered. Water is flowing through the diversion on the left down the tailings pile and being filtered at the culvert which runs under CR53.

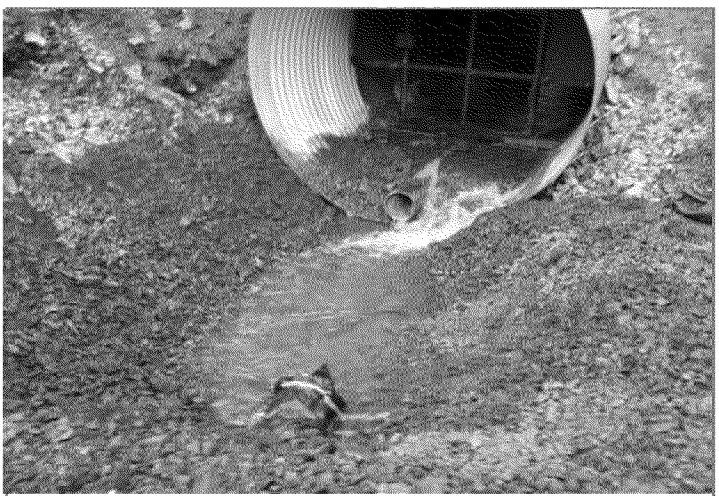
Photo 14

View of peat material being used to seal the area around the face of the 14 inch PVC pipe.The peat was hydrophobic and created a good barrier against infiltration through the rock pad.

Photo 15

View of heavy plastic sheeting being used to line the adit pool. The PVC was positioned so that all of the water leaving the adit was directed into the 14 inch PVC pipe in the foreground.

Photo 16



View of reconstructed adit pool.

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DAILY PHOTO LOG

Photo 17

Second view of reconstructed work area at the adit in July 2013. The pad work surface area doubled in size after the reconstruction.

Photo 18

View of water discharge from 14 inch pipe in August upon returning to the adit. There was no observed leakage through the rock pad after the reconstruction work.

Photo 19

View of two 6900 gallon polyethylene plastic tanks intended for backup water storage in the event the water and solids management system failed or additional capacity was needed.

Photo 20

View of ERRS crew installing 6 inch PVC pipe under CR53 toward settling pond.

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Photo Log

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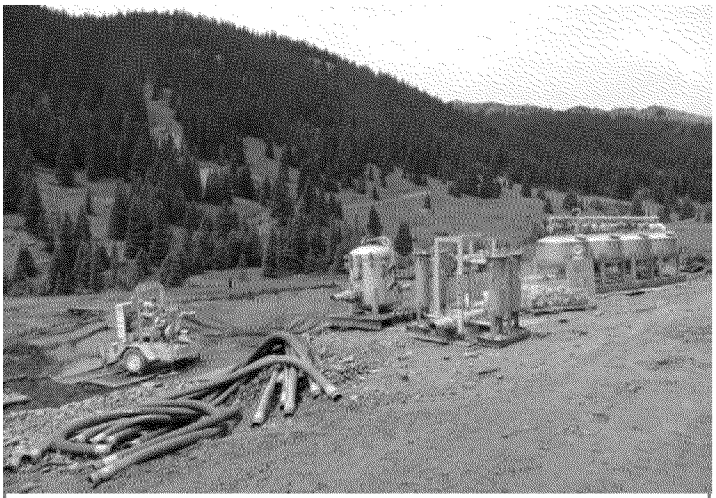
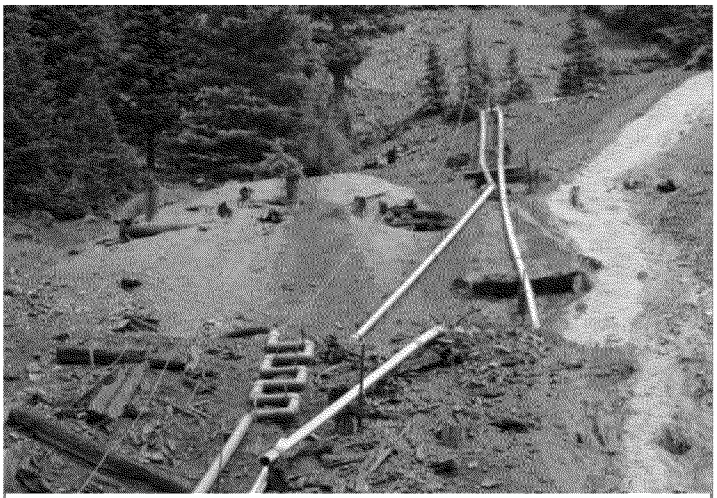
DAILY PHOTO LOG

Photo 21



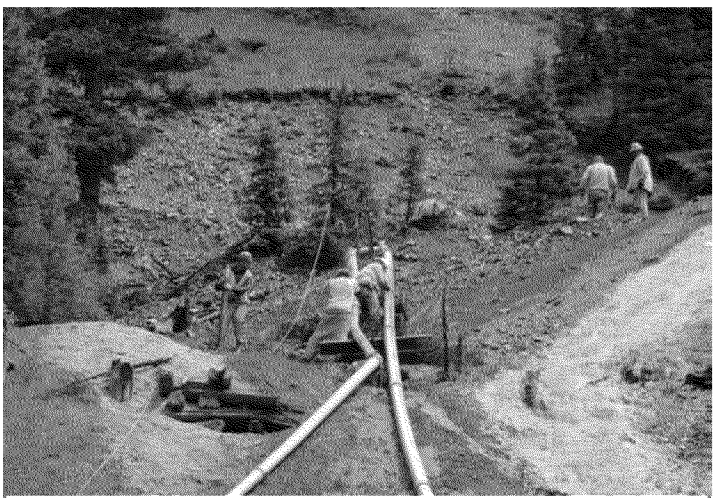
View of multi-media filtration system. Note the 4 stage sand/gravel filters on right, bag filters located in center, and one of two industrial diesel powered water pumps on left.

Photo 22



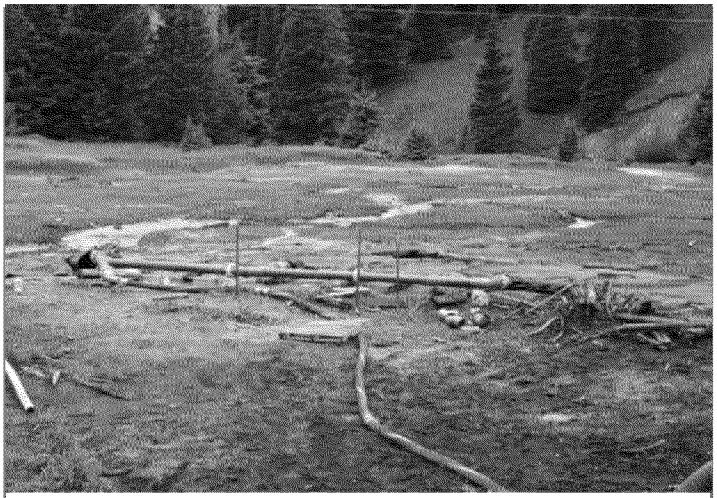
View of first serpentine section installed on tailings pile (90 degree angle PVC piping). The LBP polymer tote and pump were later staged on the flat surface at the top of the serpentine section.

Photo 23



View of Rain for Rent personnel assembling 6 inch aluminum piping down tailings pile. Aluminum pipe terminated at the cross cut road on the tailings pile.

Photo 24



View of 15' x 15' backup filter bags positioned down gradient of the settling pond. The 4 inch hose in the foreground was connected to the pump system via a valve manifold for quick access.

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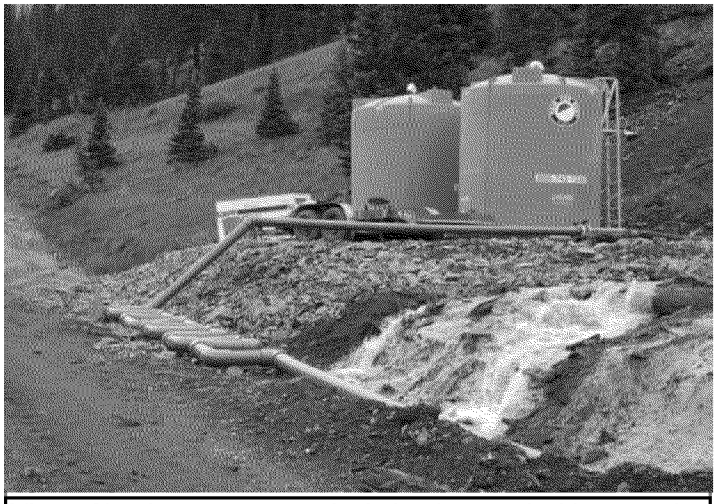
Photo 25

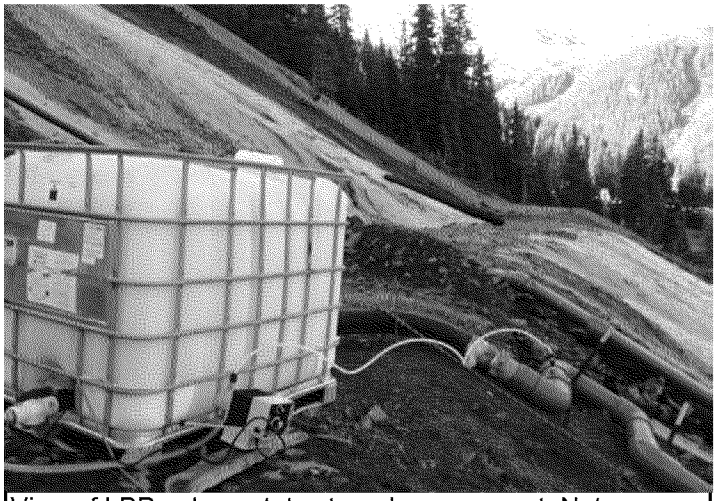


View of backup storage tanks in background with second serpentine section positioned below the pad where the Chitosan Flocculent would later be placed. Water could be diverted into the tanks or into the serpentine section via a valve manifold (red handles near tank).

Photo 26

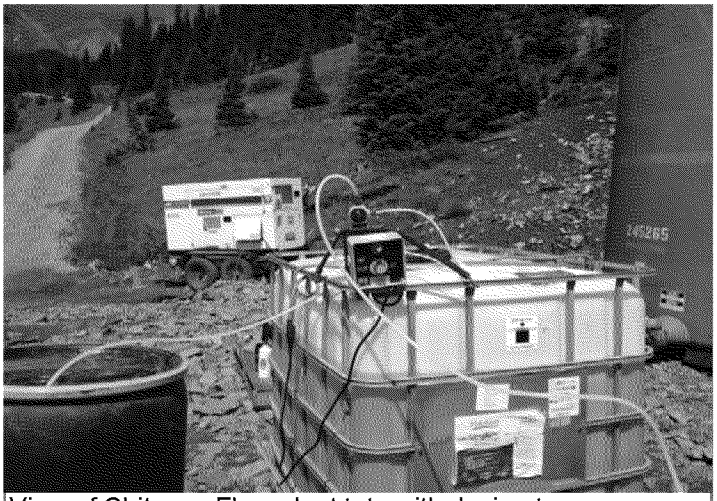
View of adit with ventilation tubing installed.

Photo 27



View of LBP polymer tote staged on cross cut, Note dosimeter pump connected at the head of the serpentine section. Pump was powered by generator staged at base of the hill.

Photo 28



View of Chitosan Flocculent tote with dosimeter pump. Barrel on left was used to mix a 50/50 ratio of flocculent and water prior to its injection into the System. Electrical generator in the background.

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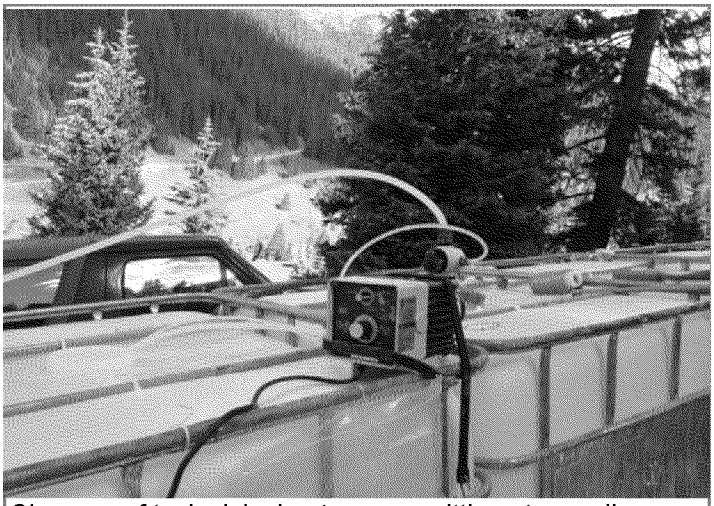
Photo 29

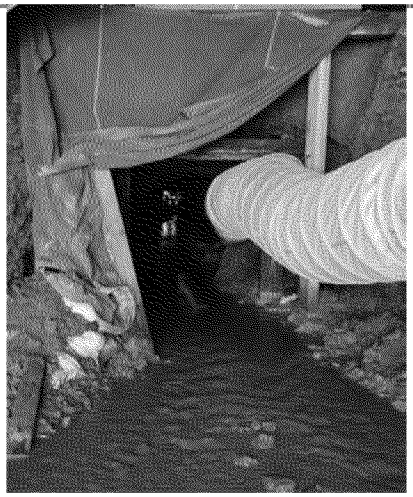


Close-up of typical dosimeter pump sitting atop sodium hydroxide totes.

Photo 30

View of final discharge point after multi-media filtration of water pumped from the settling pond. Filtered water flows to Cement Creek located in the valley to the right.

Photo 31



View of entry team as they approach the exit, note dark red sludge entrained in the water.

Photo 32

View of floating diffuser in foreground and sludge which was captured in the settling pond. Estimated volume of sludge captured by the system was 800-1000 cubic feet.

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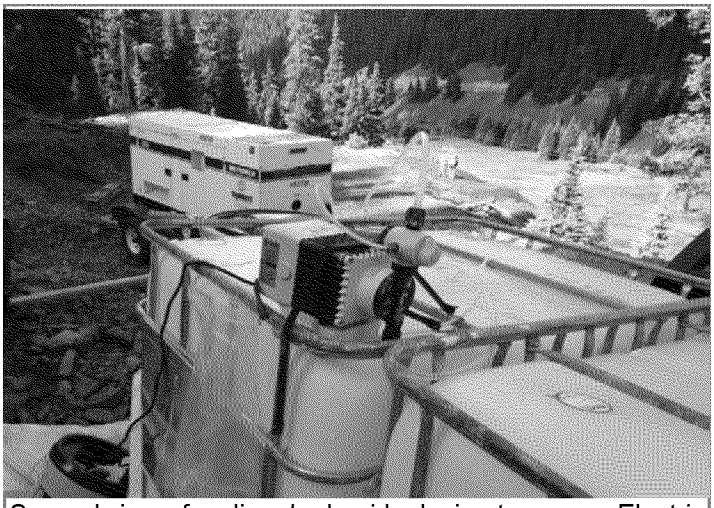
Photo 33



Second view of sodium hydroxide dosimeter pump. Electric generator in background provided electrical power for equipment staged at the portal work area.

Photo 34

View of settling pond and multi-media filtration system from adit atop the tailings pile. Red stained areas are result of uncontrolled historical mine water discharge.

Photo 35

View of 6 inch PVC two valve manifold located at the adit pool. The manifold could direct water into the treatment system on left or down the tailings pile.

Photo 36

View of water being diverted down the tailings pile by the PVC manifold. At the end of each dayflow to the treatment system would be stopped and the water was allowed to flow down its natural path.

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DAILY PHOTO LOG

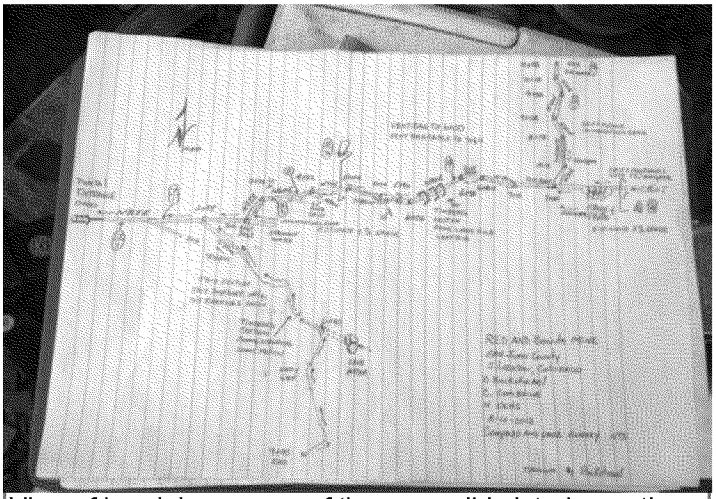
Photo 37

View of electric ventilation fan at the adit.

Photo 38

View of ERRS personnel agitating the water and sludge in the adit pool. This served two purposes; it would mix the sodium hydroxide and mobilize settled sludge into the water column.

Photo 39



View of hand drawn map of the accessible interior portion of the mine created by Frontier Environmental personnel.

Photo 40

View of untreated (left) and chemically treated mine water on right. Note congealed solids with clear water on surface. The results on the right represent what occurred in the settling pond.

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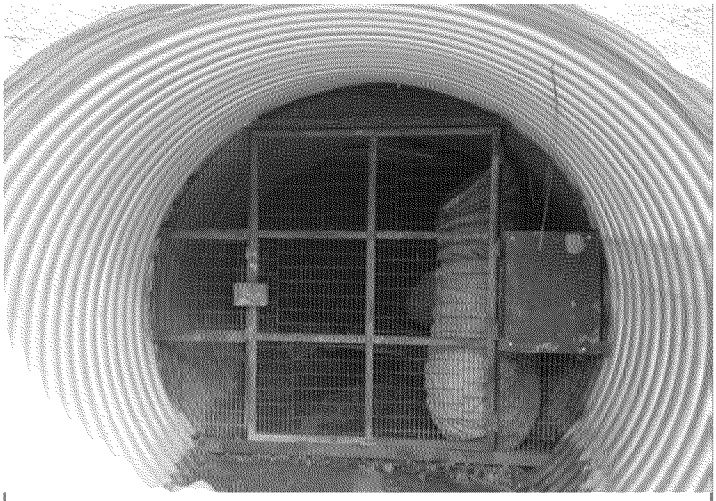
DAILY PHOTO LOG

Photo 45

View of sand bag dam material after it was removed from the mine because it created a risk during an emergency egress and retained a large amount of sludge behind them.

Photo 46



View of locked portal gate after the project was completed in August.

September Solids Removal

Photo 47

View of sludge solids in September 3, 2013 prior to their partial removal. The solids in the southern cell in the left side of the photo were removed, half of the solids in the northern cell in the upper right were removed.

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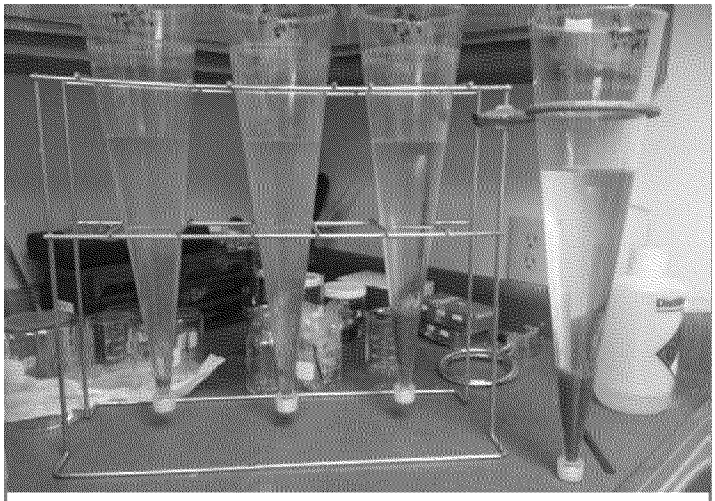
DAILY PHOTO LOG

Photo 48



Laboratory settling tests. From left to right: Cone 1 has pH 3.5 and granular floc; Cone 2 has pH 3.5 and dissolved floc; Cone 3 has pH 7 and granular floc; Cone 4 has pH 7 and dissolved floc. Best settling in Cone 4.

Photo 49

ER excavating 2013 pond solids prior to 2014 water treatment efforts.

Photo 50

Overview of settling pond and flow regime prior to water treatment. Water in ponds is from precipitation.

Photo 51

Overview of pond prior to water treatment. Water entered pond via pipe in right foreground, flowed over berms, then was discharged by pump attached to blue barrels at left center of photo.

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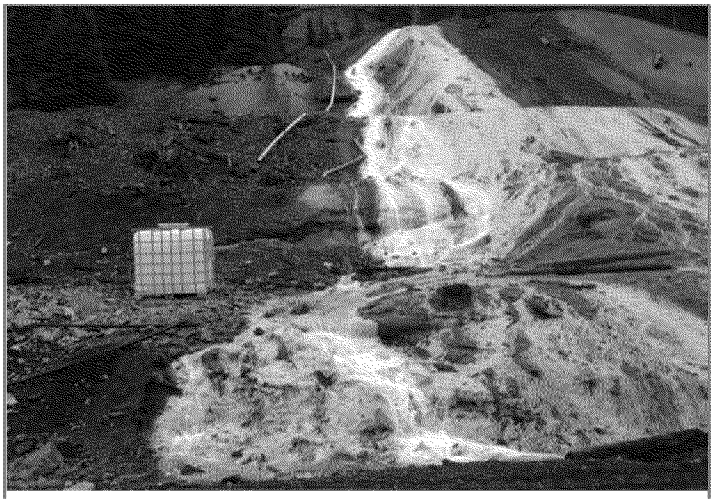
DAILY PHOTO LOG

Photo 52

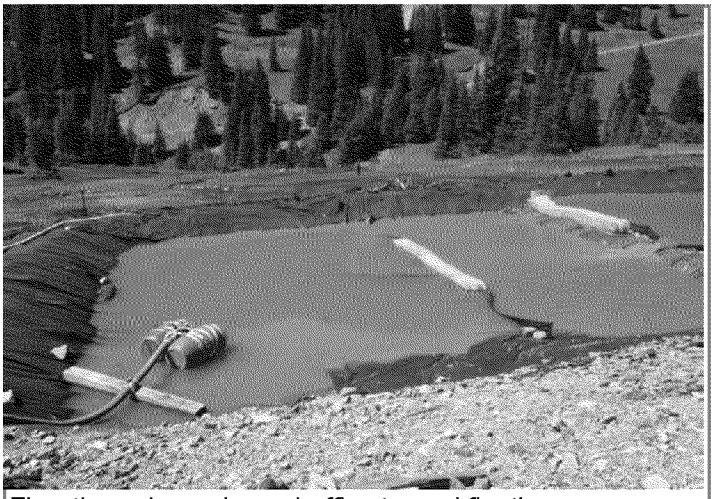


Water flows downhill on left portion of normal flow path. pH measurement near log to right of flocculant tote. Flocculant added from tote to stream of water via gravity. Water flows into channel at side of CR 53 (toward right in photo).

Photo 53

Water flows in channel adjacent to CR 53 to plywood headgate. Photo shows normal flow path. During water treatment, headgate was closed and water flowed into pipe and under road to the settling pond.

Photo 54



Flow through pond over baffles toward floating pump attached to blue barrels. Note extra capacity of pond if baffle height is increased and water flows in serpentine pattern.

Photo 55

Discharge from pond to traditional flow path toward Cement Creek.

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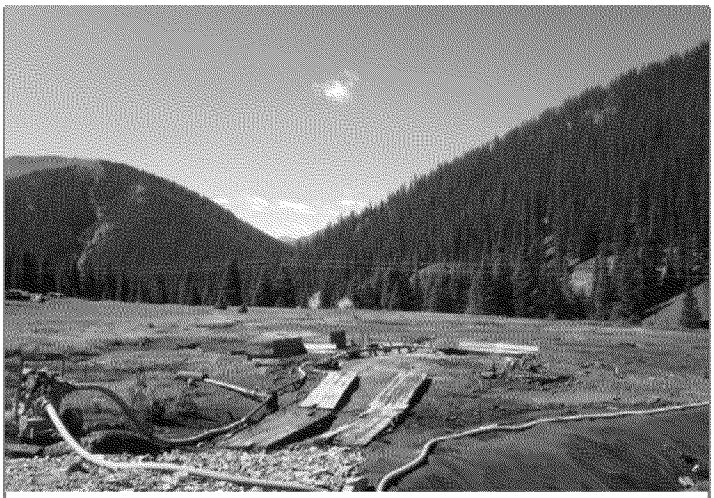
Photo 56

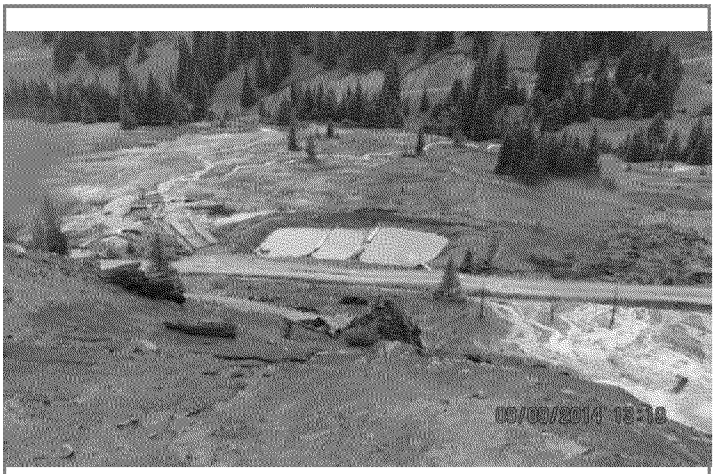


Pond discharge setup. Pump at lower left directed flow to traditional flow path toward Cement Creek or to filter bags in lower center of photo.

Photo 57

Filter bag setup.

Photo 58



Overview of water treatment.

Photo 59

Packer test setup.

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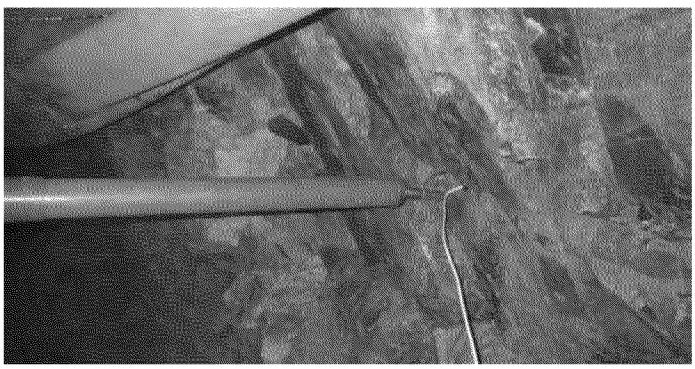
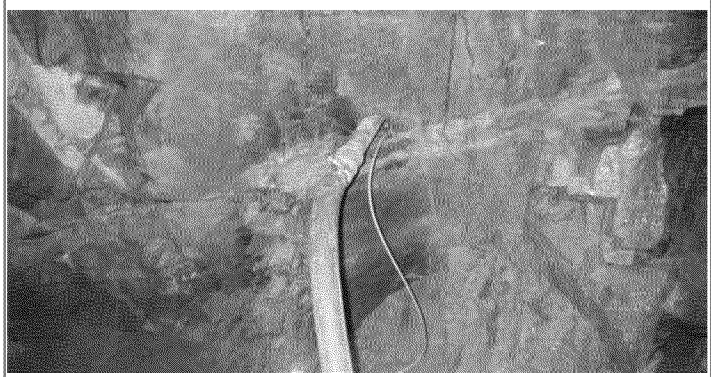
Photo 60



Inserting packer.

Photo 61



Packer testing.

APPENDIX B
WATER AND SOLIDS MANAGEMENT

APPENDIX B
Water and Solids Management

TITRATION AND SETTLING TESTS - 2013

A sample of high-sludge content mine water was collected and submitted to Accutest Laboratory for titration with 50% sodium hydroxide. The titration had the following results:

0.10 ml of 50% NaOH to neutralize a 1L sample to pH 4.97
0.15 ml of 50% NaOH to neutralize a 1L sample to pH 5.94
0.20 ml of 50% NaOH to neutralize a 1L sample to pH 7.04

The results were used to estimate the amount of sodium hydroxide needed to neutralize the water to pH 5.5 to 6. The target pH levels were based on the efficiency of the flocculants that would be added to the water to enhance settling in the pond.

On-site bucket tests were conducted to evaluate the effects of adding LBP polymer, Chitosan flocculant, and sodium hydroxide to high-sludge content mine water. The tests showed:

- pH above 5.5 to 6 was needed for effective settling (and allowed the use of aluminum piping)
- LBP polymer significantly decreased the settling time and improved water clarity
- The most effective sequence of material addition was sodium hydroxide-polymer-Chitosan.

TITRATION AND SETTLING TESTS - 2014

High-sludge water was collected from the portal pool located just outside the mine. Water was stirred up prior to collecting the sample to mobilize solids typically present in mine discharge during mine entries. The water was titrated to determine the amount of sodium hydroxide needed to neutralize the water to pH 5 to 7. The water was also used in cone settling tests to determine the best application method and rate for Brennfloc.

Titration

Mine water (500 milliliters) was titrated with 25% sodium hydroxide in the EPA warehouse laboratory. The titration results are shown below

25% NaOH (mL)	Test 1 pH	Test 2 pH
0	3.42	3.61
0.05	4.17	4.45
0.1	5.11	5.12
0.15	5.43	5.5
0.2	5.71	5.74
0.25	5.93	5.91
0.3	6.04	6.05
0.35	6.18	6.17
0.4	6.31	6.32
0.45	6.48	6.52

25% NaOH (mL)	Test 1 pH	Test 2 pH
0.5	6.58	6.78
0.55	6.82	7.41
0.6	7.24	--

Based on the above results and an estimated mine discharge flow of 300 gpm, the initial sodium hydroxide addition rate was 1.25 mL/min.

Laboratory Cone Tests

Cone tests were performed using dissolved and particulate Brennfloc flocculent. A 1% Brennfloc solution was prepared using 1 gram of Brennfloc with 100 milliliters (mL) water and used in the test.

Test scheme:
Cone 1 = pH 3.5, granular Brennfloc
Cone 2 = pH 3.5, dissolved Brennfloc
Cone 3 = pH 7, granular Brennfloc
Cone 4 = pH 7, dissolved Brennfloc

The following observations were made after addition of Brennfloc.

- Dissolved Brennfloc added to pH 7 water provided the best settling.
- Cones 1 and 2 (pH 3.5) were somewhat affected by the Brennfloc, but were still distinctly cloudy orange.
- Cones 3 and 4 (pH 7) settled better than Cones 1 and 2.
- Noticable particulate settling occurred at pH 5, but settling was better at 6.5. There was minimal improvement when pH increased to 7.

The following observations were made regarding handling of Brennfloc:

- The 1% Brennfloc solution was very viscous and not pumpable. A 0.5% solution is recommended for field use.
- Granular Brennfloc should be added slowly to a large volume of water while stirring to prevent congealing. The mixture should sit at least an hour to stabilize.
- Brennfloc expands in water.
- Granular Brennfloc does not work as well as dissolved Brennfloc and has the potential to clog a filter. Even with stirring, Cone 1 had a plug of congealed flocculant in the bottom.
- Granular Brennfloc did not form a plug in the pH 7 water (Cone 3) but also did not remove the smaller particulate from the water as well as the dissolved Brennfloc.
- Thorough mixing of Brennfloc solution with mine water is recommended to maximize contact with mine water particulates.

On-Site Bucket Tests

On-site bucket tests were conducted on August 27 and 28, 2014 to fine-tune the quantities of sodium hydroxide and Brennfloc required to achieve solids settling. The bucket tests were conducted with water stirred up from the pond outside the portal (portal pool). The results indicated the following:

- Tests performed at pH 5.1, 6, and 6.4 with equal amounts of a 0.5% Brennfloc solution indicated that the higher pH solution settled best, but the water remained slightly cloudy.
- Particulate Brennfloc was not as effective as Brennfloc solution in settling solids within 15 minutes.
- Sodium hydroxide requirement to achieve pH 6 was 0.21 mL/2gallons = 0.3L/min for 300 gpm flow.
- 1 mL of 0.05% Brennfloc solution per 2 gallons of water was adequate to achieve settling in 15 minutes in buckets with pH 6 to 6.5 water.
- Larger particles developed in higher pH water.
- 0.05% Brennfloc flows through peristaltic pump at approximately 0.5 L/min.
- Water collected from the portal pool increased in pH by the end of the bucket tests to approximately 4. The mine was inaccessible to kick up "fresh" solids and water from the in the mine. The increased pH may also indicate lower solids content, so the water used in the tests may have different results than would occur with water and solids fresh from the mine.

APPENDIX C
DRMS REPORTS

COLORADO
Division of Reclamation, Mining and Safety
Department of Natural Resources

1313 Sherman Street, Room 215
Denver, CO 80203

DATE: August 19, 2014

BY: Allen Sorenson

RE: ***Preliminary Evaluation of Feasibility for Water Impounding Concrete Bulkheads, Red and Bonita Mine, San Juan County Colorado***

Background

The Red and Bonita Mine adit is located ten miles north of the Town of Silverton on the east side of the valley of Cement Creek. The Red and Bonita adit drains the mine workings and surrounding rock with a discharge at the portal measured at 336 gallons per minute (gpm) in May 2009. Subsequent flow measurements from the adit are 180 gpm in April 2010, 314 gpm in May 2012, 202 gpm in October 2012, and 197 gpm in May 2013. The U.S. Environmental Protection Agency (EPA) and the Colorado Inactive Mine Reclamation Program (CIRMP) have undertaken a preliminary evaluation of feasibility to install water impounding concrete bulkheads in the Red and Bonita adit.

Water impounding concrete bulkheads installed at strategic locations in draining and discharging underground mine workings have the potential to flood the workings and create a mine pool that will eventually establish a ground water system with water table and flow paths similar to the pre-mining system. Saturation of sulfide minerals in the flooded workings and country rock will limit the generation of acid rock drainage (ARD) and bulkhead installation will minimize direct discharge of ARD from mine portals. The Red and Bonita discharge pH measured in 2009-2011 is slightly acidic and the dissolved metals carried by the discharge are derived by ARD mechanisms through the oxidation of sulfide minerals. After the collapsed portal was reopened by EPA in 2011, the pH of the adit discharge became more acidic, exhibiting a pH of between four and five standard units during the summer of 2012. It has also been observed that the pH of the adit discharge drops when metal oxy-hydroxide sediments and precipitates are stirred-up by activities within the mine. Otherwise, the pH of the mine water has ranged from a low of 5.31 to a high of 6.06 standard units over the course of nine sampling event from September of 2010 to May of 2013.

Multiple bulkheads have previously been installed in mine workings in the vicinity of the Red and Bonita. Notably, since bulkheads were installed in the American Tunnel in the 1990s, located approximately one-half mile south and 330 feet below the Red and Bonita workings, the flow at the

Red and Bonita portal has increased from a negligible discharge to the present levels in excess of 300 gallons per minute.

Bulkhead Design Considerations

Einarson and Abel (1990) present a step-by-step procedure for design of underground water impounding bulkheads. Conservatism in design of the bulkheads is necessary because of the safety and environmental implications of a bulkhead failure, the long life required for the bulkheads, and the ultimate inaccessibility of the bulkheads. The American Concrete Institute's "Building Code Requirements for Reinforced Concrete (ACI 318-89)" is used because the bulkheads are analogous to reinforced deep-beam concrete structures and because of the inherent conservatism of the code. The analysis presented in this memo generally follows the Einarson and Abel template.

The portal of the Red and Bonita adit is faced-up in ferricrete, and the adit is then driven through Burns Member rhyodacite of Silverton Volcanics Formation. The Burns Member was deposited adjacent to the San Juan and Uncompahgre calderas after their collapse, but before subsidence of the Silverton caldera. In order for bulkheads in the Red and Bonita adit to be effective, they must be installed in locations where water pressure behind the bulkhead will not hydrofrac (fracture) the surrounding rock. When the valve and monitoring tube on the main American tunnel bulkhead were grouted shut in May 2001, the mine pool elevation in the Sunnyside Mine workings had equilibrated at 11,661 feet. For the purpose of this feasibility evaluation, it is assumed that Sunnyside pool pressure will be exerted on any Red and Bonita bulkheads, which would be at an elevation of about 10, 973 feet. The maximum hydraulic head and pressure at a potential Red and Bonita bulkhead are calculated as follows:

H 11,661' 10,973' 688 feet (10,973 feet is the elevation of the Red and Bonita portal)

$$\frac{H \quad _w}{144 in^2 / ft^2} \quad \frac{688 \quad 62.4}{144} \quad 298 psi$$

where: H = hydrostatic head (feet)
γ_w = water density (62.4 pounds per square foot)
ρ = pressure head (psi)

The bulkhead must be constructed at a depth below ground surface that will provide sufficient overburden pressure to prevent hydrostatic pressure from the impounded water hydrofracing the rock surrounding the bulkhead. The hydrostatic pressure at which hydrofracing will occur is the formation

breakdown pressure. Intentional hydrofracing of rock from within drill holes is frequently undertaken by the petroleum industry for the purpose of stimulating oil well production, and as a result has been intensively studied and is well understood. In oil field applications, formation breakdown pressure (B_p) is a function of (1) the tensile strength of the rock immediately adjacent to the drill hole, (2) the in situ stress field in the plane perpendicular to the drill hole, and (3) the pore pressure present in the formation. Bredehoeft, et al (1976) presented the following equation for breakdown pressure:

$$B_p \quad T_s \quad (3 \quad S_{\min}) \quad S_{\max} \quad P_f$$

where: B_p = breakdown pressure
T_s = tensile strength
S_{min} = minimum stress normal to the drill hole
S_{max} = maximum stress normal to the drill hole
P_f = formation pore pressure
all terms in psi

The equation can be simplified for the case of hydraulic pressure behind a bulkhead in an adit. The tensile strength can be assumed to be zero because the adit wall rock is jointed and is fractured by blasting, and the pore pressure in and near adit wall rock must be low and can be assumed to be zero. A simple assumption is that hydrostatic stress conditions are equal to the overburden stress. This assumption is generally conservative since the overburden stress must be present and the more general stress state measured is for the horizontal stresses to equal or exceed the overburden stress. Normal formation breakdown pressures encountered in oil field work range from 1.4 to 2.8 times the overburden stress, indicating that the hydrostatic stress assumption where the breakdown pressure equals two times the overburden stress is not unreasonable. This analysis yields the following simplified breakdown equation:

$$S_{ob} \quad \frac{B_p}{2}$$

where: S_{ob} = overburden stress in psi

The overburden pressure is the product of the height and the density of the rock overlying the bulkhead. A density of 170 pounds per cubic foot is conservatively at the low end of expected density for the Burns member rhyodacite that the Red and Bonita adit penetrates. The minimum height of overburden cover for the bulkhead to prevent hydrofracing can be calculated as follows:

$$S_{ob} = \frac{H}{144 in^2/ft^2} + \frac{B_p}{2}$$

where: γ = rock density in pounds per cubic foot
H = height of overburden in feet

Solving for H yields:

$$H = \frac{72 B_p}{\gamma}$$

For a bulkhead in the Red and Bonita adit, the required minimum overburden height to prevent hyrofracing is 126 feet for the 170 pcf overburden rock density and the 298 psi maximum hydraulic pressure, as follows:

$$H = \frac{72 \times 298}{170} = 126 \text{ feet}$$

At the the nearest to surface location identified during reconnaissance of the Red and Bonita as suitable for bulkhead installation, 265 feet inby the portal, there is approximately 215 feet of overburden. Therefore, hydrofracing around a bulkhead at that location, or at any locations inby where bulkheads could be installed, will not occur.

Bulkhead Length

Design for Hydraulic Pressure Gradient

The pressure gradient across a bulkhead is the hydraulic pressure divided by the length of the bulkhead. Garrett and Campbell-Pitt (1961) present a graph indicating and ungrouted plug will withstand a pressure gradient of 21 psi/ft at a safety factor of one. They recommend a minimum safety factor of four in good rock, yielding a recommended maximum pressure gradient of just over 5 psi/ft. They further indicated that low-pressure grouting of the bulkhead/rock contact would permit pressure gradients of 165 psi/ft without leakage. Applying a safety factor of four produces a design pressure gradient of 41 psi/ft. Using these criteria allows the following calculations of bulkhead length for the pressure gradient component of the design:

Ungrouted Bulkhead $$L = \frac{298 psi}{5 psi/ft} = 59.6 feet$$

Low Pressure Grouted Bulkhead $L \quad \frac{298\,psi}{41\,psi/ft} \quad 7.3\,feet$

Clearly, with an almost eight fold decrease in required bulkhead length, low pressure grouting is a necessity for the proposed bulkhead.

Design for Concrete Shear on Red and Bonita Adit Perimeter

The length of the bulkhead must be sufficient to keep the shear stress developed in the bulkhead concrete below the ACI 318-89 limits. Shear strength of concrete is related to its compressive strength as follows:

$f'_s \quad 2\sqrt{f'_c} \quad 2\sqrt{3000} \quad 110\,psi$ (ACI 318-89, Section 11.3.1.1)

where: f'_s concrete shear strength (psi)

f'_c concrete compressive strength (psi)

It can be assumed that the adit wall rock at the bulkhead location has higher shear strength than the concrete, so concrete shear will control the design. The required bulkhead length for the concrete shear component of design, with minimum bulkhead concrete compressive strength specified at 3000 psi, is calculated as follows:

$L \quad \frac{h \square}{2 \quad h \square \quad f'_s} \quad \frac{298 \quad 8 \quad 8}{2 \quad 8 \quad 8 \quad 110} \quad 5.4\,\text{feet}$

where: L = bulkhead length (feet)

ρ = pressure head (psi)

h = adit height (feet)

$\square$ = adit width (feet)

f'_s concrete shear strength (psi)

Therefore, the 7.3 foot minimum bulkhead length required for pressure gradient exceeds the bulkhead length required for concrete shear, and pressure gradient controls the design at this stage of the analysis. Note that the 8' x 8' adit dimensions input to the concrete shear equation are considered to be conservative based on observations and measurements made in the Red and Bonita adit. However, the maximum adit dimensions at the bulkhead location must be precisely measured and concrete shear analysis verified after the bulkhead location has been scaled and cleaned in preparation for bulkhead installation.

Design for Plain Concrete Deep Beam Bending Stress

American Concrete Institute codes can be used to determine the required length for a plain concrete bulkhead to resist deep-beam bending stress. For the analysis, the dead or fluid load acting on the bulkhead is multiplied by 1.4 (ACI 318-89, Section 9.2.1) and the plain concrete bending strength reduction factor of 0.65 is applied (ACI 318-77, Section 9.3.2). ACI directs that the design tensile bending strength be:

$f_t \quad 5\sqrt{f'_c}$ (ACI 318-77, Section 15.11.1)

$f_t \quad 5\sqrt{3000} \quad 273\,\text{psi}$, with minimum 3000 psi compressive strength specified

$1.4 \quad 144\,in^2/ft^2 \quad 1.4 \quad 298 \quad 144 \quad 60077\,\text{pounds per foot}$

$M_u \quad \frac{\square^2}{8} \quad \frac{60077 \quad 8^2}{8} \quad 480616\,\text{foot pounds}$

$M_n \quad \frac{M_u}{0.65} \quad \frac{480616}{0.65} \quad 739409\,\text{foot pounds}$

$$S \quad \frac{I}{c} \quad \frac{bh^3/12}{h/2}$$

$$f_t \quad \frac{M_n}{S} \quad \frac{M_n}{(bh^3/12)/(h/2)} \quad \frac{6 \quad M_n}{bh^2}$$

$$h^2 \quad \frac{6 \quad M_n}{b \quad f_t} \quad \frac{6 \quad 739409}{1 \quad 273 \quad 144 in^2/ft^2} \quad 113 \text{ square feet}$$

h 10.6 feet

where: f_t = flexural stress (psi)

f'_c concrete compressive strength (psi)

ω = pressure (dead) load (pounds per foot)

ρ = pressure head (psi)

M_u = maximum bending moment (foot pounds)

□= adit width (feet)

M_n = design bending moment (foot pounds)

S = section modulus (cubic inches)

I = moment of inertia (inches^4)

c = centroidal distance (inches)

b = beam width (one inch)

h = bulkhead length (feet)

The forgoing analysis demonstrates that required minimum length for a plain concrete bulkhead is 10.6 feet, a significant increase over the bulkhead length of 7.3 feet required for the hydraulic pressure gradient aspect of the design. This increase in bulkhead length for plain concrete combined with the advisability of including reinforcing steel on the outby end of the bulkhead to control temperature and shrinkage induced stresses, leads to the conclusion that the bulkhead must be reinforced.

Design for Reinforced Concrete Deep Beam Bending Stress

The following design calculations follow ACI 318-89, section 9.3.2.3 and Wang and Salmon (1985).

$$C \quad f'_c \; b_w \; a \quad 0.85 \quad 3000 \quad 12 \quad a \quad 30600 \quad a$$

$$T \quad A_s \quad f_y \quad 60000 \quad A_s$$

$$C \quad T$$

$$a \quad \frac{60000 \quad A_s}{30600} \quad 1.961 \quad A_s$$

$$M_u \quad \frac{\square^2}{8} \quad \frac{60077 \quad 8^2}{8} \quad 480616 \text{ foot pounds}$$

$$M_n \quad \frac{M_u}{0.9} \quad \frac{480616}{0.9} \quad 534018 \text{ foot pounds} = 6408216 \text{ inch pounds}$$

$$M_n \quad A_s \quad f_y \quad d \quad \frac{a}{2}$$

$$d \quad L \quad m_c \quad 7.3 feet \quad \frac{12 inches}{foot} \quad 3.5 \quad 84.1 \text{inches}$$

$$M_n \quad 60000 \quad A_s \quad 74.5 \quad \frac{1.961 \quad A_s}{2} \quad (5046000 \quad A_s) \quad (58830 \quad A_s^2)$$

$$6408216 \quad (5046000 \quad A_s) \quad (58830 \quad A_s^2)$$

$$58830 A_s^2 \quad 5046000 A_s \quad 6408216 \quad 0$$

$$(A_s \quad 84.48)(58830 A_s \quad 75890.7) \quad 0$$

$$A_s \quad \frac{75890.7}{58830} \quad 1.29 \text{ square inches per foot of beam is the reinforcing steel area required}$$

Standard #9 rebar has 1.00 square inch cross section, so installation of #9 bars on 9 inch centers, both ways, yields:

$$A_s \quad \frac{1.0 sq.in.}{0.75 ft.} \quad 1.33 \text{ square inches per foot of beam reinforcing steel area}$$

where: C = compressive bending force (lb)

= ACI strength reduction factor; 0.85 shear concrete; 0.90 flexure rebar

f'_c concrete compressive strength (psi)

b_w = beam web width = 12 inches

a = compression zone depth (inches)

T = tensile bending force (pounds)

A_s = area of rebar (square inches per foot)

f_y = rebar yield strength = 60,000 psi for standard bars

M_u = maximum bending moment (foot pounds)

ω = pressure (dead) load (pounds per foot)

□= adit width (feet)

M_n = design bending moment (foot pounds)

d = distance, extreme compression fiber to rebar centroid (inches)

L = bulkhead length (feet)

m_c = minimum cover, form face to rebar surface = 3.5 inches

Preliminary Design Parameters for the Red and Bonita Bulkhead

- bulkhead dimensions are 8' x 8' x 7.3' long
- bulkhead volume is 17.3 cubic yards
- low pressure grouting is necessary
- flexural reinforcing at the bulkhead outby end is #9 bars on 9 inch centers, both ways
- temperature shrinkage rebar at the bulkhead inby end is #6 bars on 12 inch centers, both ways
- stainless steel bypass and monitoring piping is necessary
- Concrete will use maximum ¾ inch aggregate, Type V cement, 16 percent fly ash, pozzolan, water/cement ratio of 0.45 by weight, and will be over sanded to enhance pumpability

Final design must be based on precise measurements of adit dimensions following scaling and cleaning at bulkhead location, and must consider bulkhead stability under seismic loading.

Underground Mine Workings

Prior to the commencement of EPA's investigations of the Red and Bonita in 2011, there was very little information available about the extent and configuration of the underground mine workings. Ransome (1901) states:

> The adit tunnel of (the Red and Bonita) mine runs in an easterly direction into Bonita Mountain, from a point about 100 feet above Cement Creek. About 3,000 feet of work has been done from this tunnel, but the ore could not be made to pay and the attempt was abandoned. The workings are no longer accessible and the lode was not seen. The Red and Bonita mill is equipped with Gates crusher, 2 sets of rolls, jigs, 10 stamps, and 4 Frue vanners.

A rudimentary layout of the Red and Bonita underground workings is depicted in an 1899 mineral survey of the adjacent American Eagle Mill site. This layout and its relationship to overlying mine claims is illustrated in the "Report of Structural Geologic Investigation, Red and Bonita Mine" DRMS, (2007), and is attached to this memorandum as Figure 1. DRMS (2007) includes a discussion of the volume of the Red and Bonita mine waste dump, and concludes that the extent of the underground workings must be much greater that depicted in the 1899 mineral survey map (3560 feet of 5ft. x 7ft. workings indicated by the mine dump versus 595 lineal feet of workings depicted on the 1899 map). As discussed below, underground entries in 2012 and 2013 verified the much greater extent of the mine.

In 2011, EPA and their contractors re-opened and stabilized the Red and Bonita adit portal, which had been collapsed for many decades (URS, 2012). In June of 2012, preparations were made for an entry into the mine to conduct reconnaissance and mapping, and to evaluate mine hydrology. It was known from the 2011 portal stabilization work that there were deposits of precipitates and sediments on the floor of the adit that would be released into the mine discharge and subsequently into Cement Creek by personnel entering the underground workings. Oxygen levels of less than 19.5 percent had been measured just inby the portal in 2011 and in 2012. Therefore, EPA and their contractors installed water treatment and filtration facilities and a ventilation fan in preparation for the underground entry. Typically, adits are driven at a slight upgrade of around one percent. Therefore, given the water line that developed when the adit was collapsed was about three feet above the mine floor at the portal, it had been hoped that the precipitates and sediments would taper and pinch out against the mine floor within approximately 300 feet of the portal.

On June 6, 2012, a three-person CIMRP team entered the mine. Oxygen levels remained safe throughout the period of underground reconnaissance, but the sediments on the floor of the adit did not pinch-out. Therefore, the team released volumes of sediment that consumed the filtration capacity of the treatment systems, and the mine entry had to be curtailed after proceeding to only about 680 feet from the portal along the main easterly heading of the mine. This easterly heading was observed to be the main route of water flow from the mine.

A sketch map of the underground workings observed during the June 2012 entry is included as Figure 2. Due to the time constraints discussed above, none of the southerly headings depicted on the sketch map were explored. Rather, the orientation of these headings were shot with a Brunton compass, and their length estimated by shining mine lamps into the headings. Since bedrock walls were observed at the distal end of each heading, these appeared to be dead ends. As will be described below, the second southerly side heading inby the portal is not a dead end, but takes an easterly turn that made it appear to end when shined with the mine lamps. These incomplete observations led to the incorrect conclusion that the 1899 map included as Figure 1 was not an accurate depiction of the underground workings.

In July and early August 2013, EPA and their contractors installed water treatment systems at the Red and Bonita with capacity to remove the large volume of sediments and precipitates from the mine discharge that would be released during thorough investigation and mapping of the mine. During this same period, EPA contractors entered the mine numerous times and to much greater depths than were possible during the 2012 reconnaissance effort. These preparations allowed a multidisciplinary team of EPA, CIMRP personnel, EPA contractors, and a local landowner to safely investigate and map the mine on August 13, 2013. The map produced by CIMRP as a result of the investigation is included as Figure 3.

Comparison of the maps in Figures 1 and 3 show that at the time of the 1899 mineral survey, the Red and Bonita workings consisted of the crosscut adit from the portal to station 2+75, the 275 drift, and the 640 drift. All of the other workings shown in Figure 3 must have been driven after the 1899 mineral survey. The extent of entry into the mine in August 2013 was terminated when flooded conditions were encountered at the eastern extend of the two main headings. Approximately 2,000 total lineal feet of workings were investigated. Given the discussion of the mine dump volume above, this means that as much as 1,560 linear feet of additional workings may extend to the east from the terminal locations of the August 2013 mine entry.

Relationship of Red and Bonita to other Mines in the Area

The two most significant and productive mines in the vicinity of the Red and Bonita are the Sunnyside Mine and the Gold King Mine. A plan map and vertical projections of the underground workings of these mines is included as Plate 8 in Burbank and Luedke (1969) and reproduced here as Figure 4. The relationship of these mines to the Red and Bonita workings is illustrated on Figure 5. Primary access to the Sunnyside Mine during its latter years of operation was via the American and Terry Tunnels. The Sunnyside Mine workings are interconnected with the Mogul Mine workings, but there is no mined connection between Sunnyside and the Gold King or the Red and Bonita. The approximate elevations of the portals to these mines are given in the following table.

Portal Name	Elevation
American Tunnel	10,617 feet
Red and Bonita	10,973 feet
Mogul	11,400 feet
Gold King 7-level	11,400 feet
Terry Tunnel	11,560 feet

At the time that the Sunnyside Mine ceased production in 1991, the American Tunnel discharged between 1600 and 1700 gallons per minute (gpm) and the Terry Tunnel discharged 10 gpm in the winter, and more than 1000 gpm during snowmelt. In the early to mid-1990s discharge from the Mogul Mine averaged around 10 gpm, from the Gold King 7-level around 5 gpm, and the Red and Bonita was essentially dry.

During the 1990s, water impounding concrete bulkheads were installed in the American and Terry Tunnels and on the B- and F-level connections between the Sunnyside and Mogul Mines. The bulkheads flooded the Sunnyside Mine workings to an elevation of 11,661 feet and elevated the local water table as fracture flow paths long drained by the American Tunnel were re-saturated. The following table lists mine discharge rates prior to and following bulkhead installation.

Mine Name	Pre-Bulkhead Discharge	Current Discharge
American Tunnel	1600 to 1700 gpm	80 to 140 gpm
Red and Bonita	Dry	220-340 gpm
Mogul Mine	10 gpm	50-150 gpm
Gold King 7-level	5 gpm	160-250 gpm

The CIMRP has created a three dimensional model of the mine workings and their relationship to surface topography. This model may be viewed at the following link, and a view from the model is included as Figure 6:

http://www.tips.osmre.gov/newsroom/success_stories/2012/2012jun-28.shtml

Bulkhead Locations

The ideal location for bulkhead installation in the Red and Bonita identified during the mine entries conducted in 2012 and 2013 is near Station 2+65 (Figure 3). A bulkhead at this location would impound essentially all of the flow from the mine. The rock at Station 2+65 is competent, but intensely jointed. However, the joints are very tight and thin. In order to further evaluate this potential bulkhead location, the rock quality and hydraulic conductivity should be measured by drilling and packer testing. Because of the confined 5'W x 7'H adit dimensions and because of the difficulty managing water and sediment during entries into the mine, jack leg drilling is recommended. Jack leg holes will not provide core for accurate Rock Quality Determination (RQD), but observation of drill action and insertion of a borehole camera following drilling to observe joints will be sufficient to evaluate RQD.

Three or four jack leg holes should be drilled into the rib and back of the adit near Station 2+65. The holes should be 10-12 feet long and two-inch in diameter to facilitate camera work and packer testing. The holes should be thoroughly jetted and washed following drilling. Packers should be installed near the collar of the holes, then pressure applied into the packed holes with water take over time recorded to calculate permeability indices. If the rock is conductive at Station 2+65, this would not necessarily rule out a bulkhead at this location, but formation grouting would be required, increasing the cost and difficulty of the project. Alternatively, a bulkhead could be installed at or around Station 4+00, identified as a suitable location during the 2013 mine entry, but a bulkhead at this location would not impound the 40-50 gpm flowing from the 275 drift. Another option would be installation of a bulkhead at Station 4+00 with a secondary bulkhead at Station 2+65. A disadvantage of this option is that several years of performance evaluation would be necessary between the installation of the first and second bulkheads.

Potential Impacts from Red and Bonita Bulkheading

Impoundment of flow from the Red and Bonita would result in an immediate and substantial reduction in metal loading to Cement Creek. The limited open mine workings behind the bulkhead would quickly fill with water, and the trough of depression in the ground water table created by the draining adit would begin to fill through the fracture flow system that controls regional ground water flow in the Upper Animas River Basin, including the Cement Creek Basin. This will eventually result in

discharge of ground water and metal loading to surface streams that will reduce the initial benefit to water quality provided by bulkheading.

It can be anticipated that following bulkhead installation in the Red and Bonita, flows from the Mogul Mine and Gold King Level-7 will increase from present rates. It can further be anticipated that ground water seepage and spring flows may increase along the North Fork and on Cement Creek. As sulfate salts precipitated in unsaturated fracture systems are dissolved and flushed out to surface streams, there is the possibility of significant metal loading to the creeks, but this first-flush impact would be temporary. Bulkheading the Red and Bonita will eventually return ground water flow paths to an approximation of the configuration that existed prior to the mine workings creating a free-flowing ground water drainage pathway.

Mogul Mine Bulkhead

In 2003, a bulkhead was installed approximately 250 feet inby the portal of the No. 1 Tunnel of the Mogul Mine. The No. 1 Tunnel was drifted along a vein structure, and was less than ideal for bulkheading due to the potential for leakage along the vein. The continuing discharge observed at the Mogul Mine is a result of leakage around the bulkhead. An option under consideration for the Mogul Mine is investigating the potential to grout zones of leakage around the bulkhead. This action, in combination with bulkheading the Red and Bonita, has the potential for long term water quality improvement in Cement Creek and the Upper Animas River.

Contingency Plan

An important consideration of bulkhead projects, is that a by-pass pipe installed through the bulkhead serves as a contingent environmental protection measure. If, even after careful evaluation and planning, bulkheads that are installed do not improve hydrologic conditions, or are found to make conditions worse, the valve on the bypass pipe can be opened and the site returned to its previous condition. Alternatively, the bypass pipe and valve can be used to manage and control the mine pool elevation. If, after sufficient time to allow for equilibration of post-valve closure hydrologic conditions, bulkheading is demonstrated to be effective, the bypass pipe and valve are grouted solid as a final closure safeguard, eliminating the both the open penetration through the structural concrete and valve corrosion issues which can significantly compromise longterm safety of the bulkhead closure.

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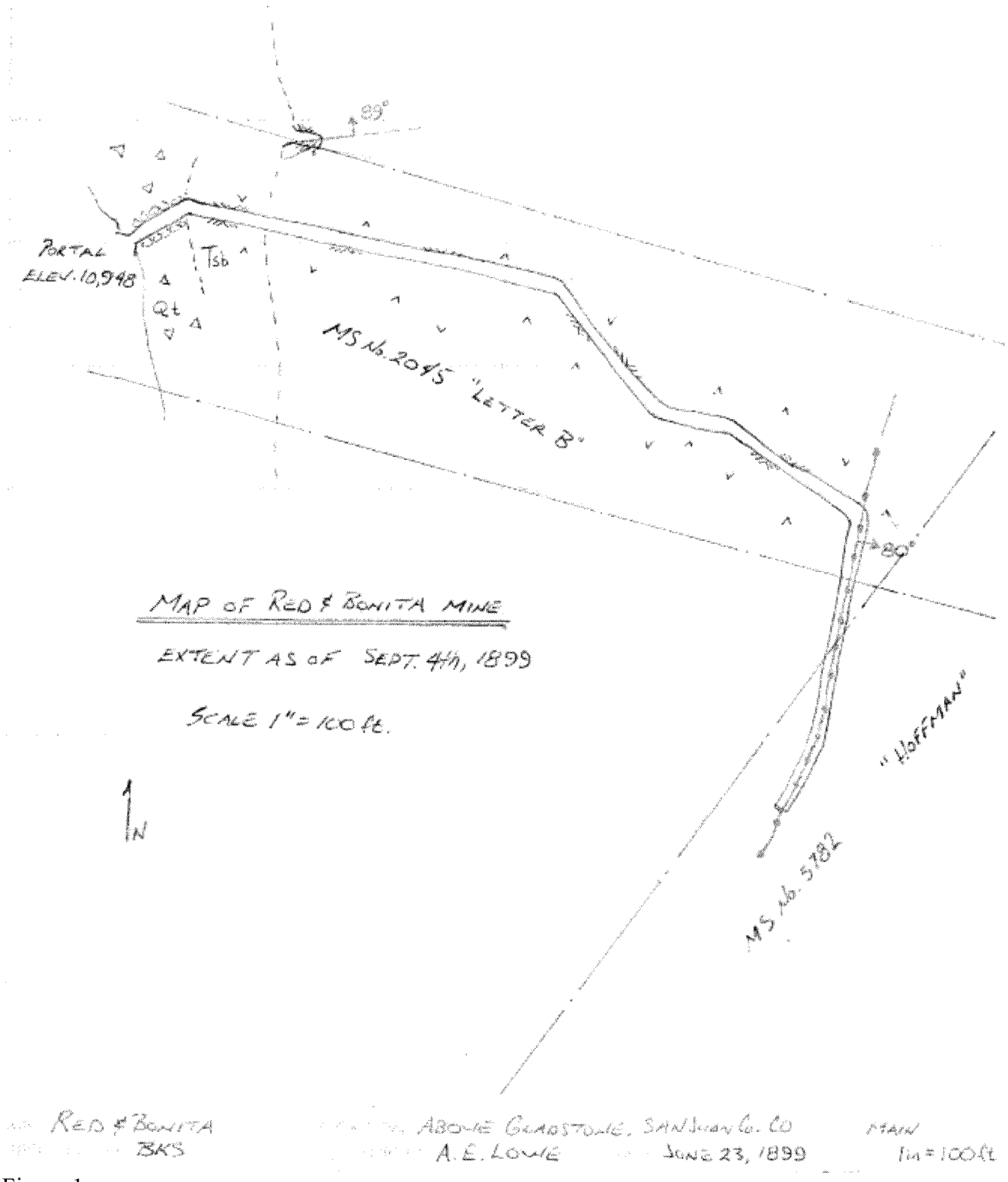

89°
PORTAL
ELEV. 10,948
Tsb
Qt
MS No. 2045 "LETTER B"
80°
MAP OF RED & BONITA MINE
EXTENT AS OF SEPT. 4th, 1899
SCALE 1" = 100 ft.
N
"HOFFMAN"
MS No. 5782
RED & BONITA
BKS
ABOVE GLADSTONE, SAN JUAN CO. CO
A. E. LOWE
JUNE 23, 1899
MAIN
1M = 100ft

Figure 1

Red and Bonita Mine, Sketch Map of June 2012 Reconnaissance of Adit

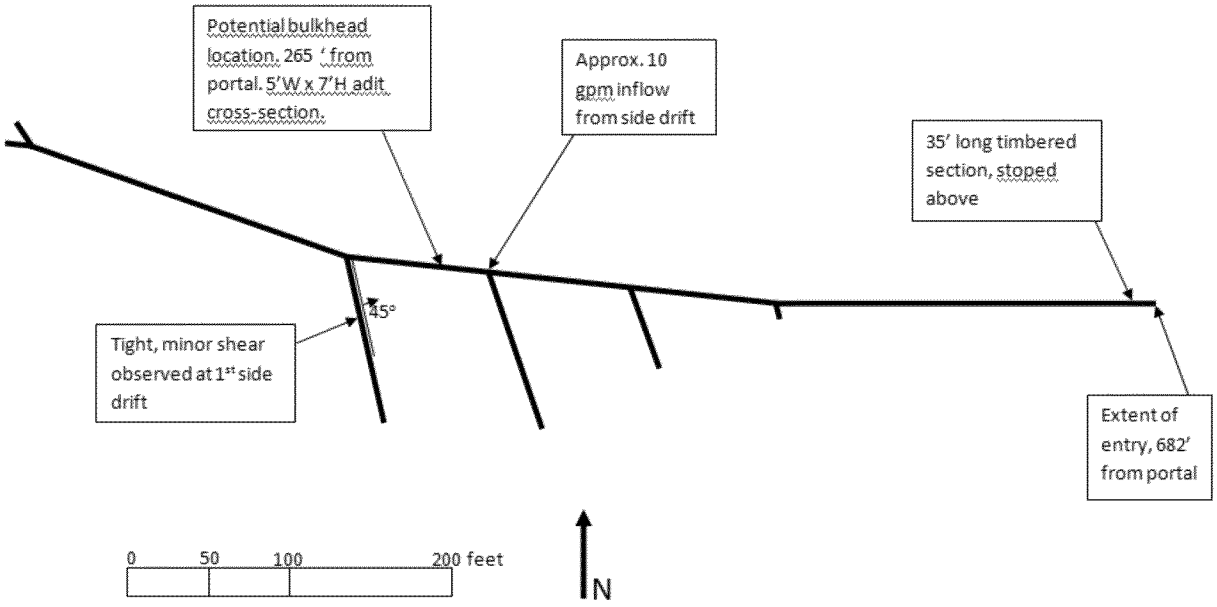


Figure 2

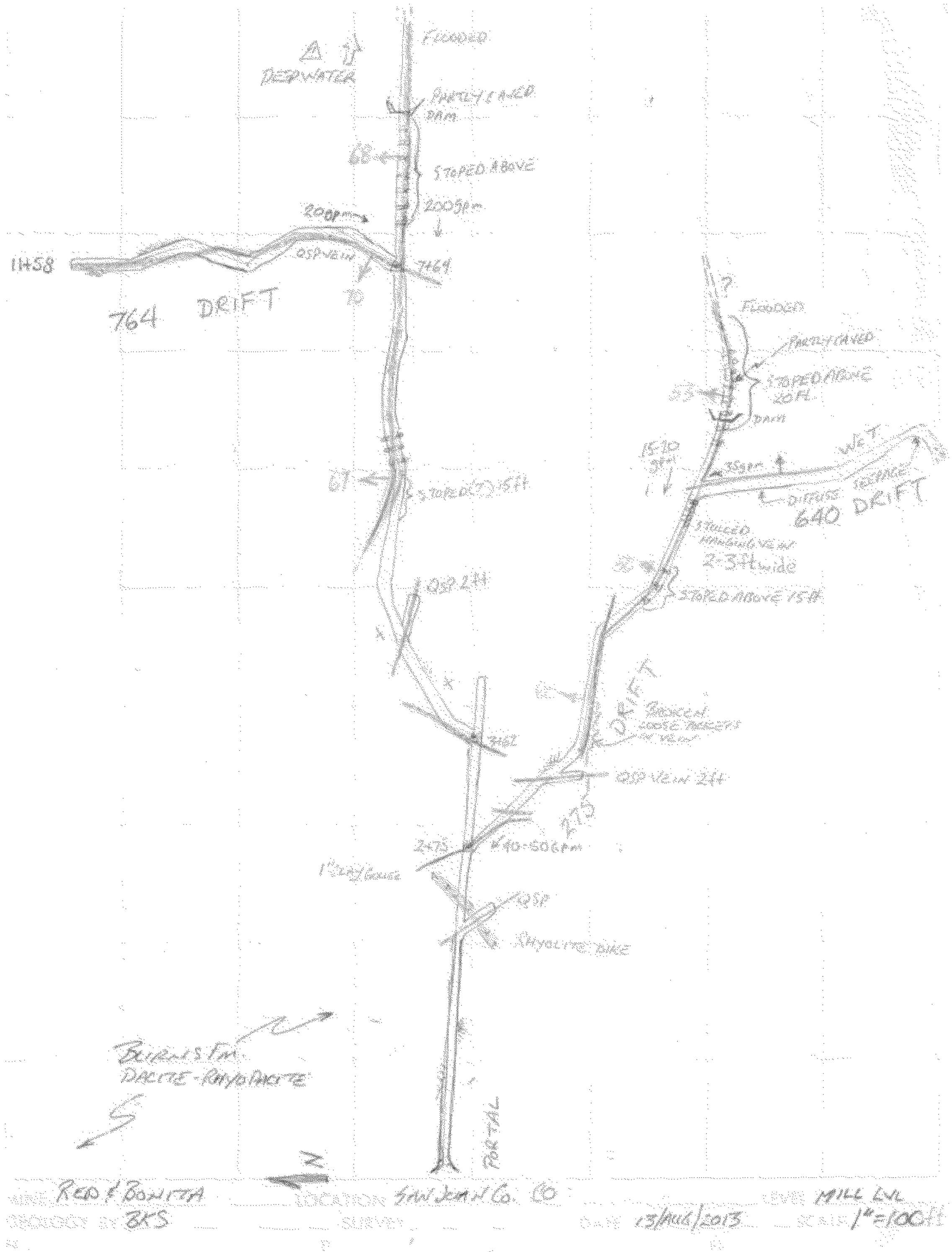

FLOODED
DEEPWATER
PARTLY CAVED
DAM
68
STOPED ABOVE
QSP VEIN
764 DRIFT
67
QSP 2ft
FLOODED
PARTLY CAVED
STOPED ABOVE
DAM
53
WET
35gpm
DIFFUSE SEEPAGE
640 DRIFT
2-3ft wide
STOPED ABOVE 15ft
DRIFT
QSP VEIN 2ft
275
40-50GPM
QSP
RHYOLITE DIKE
PORTAL
N
RED & BONITA
SAN JUAN Co. CO
MILL LVL
BKS
13/AUG/2013
1"=100ft

Figure 3

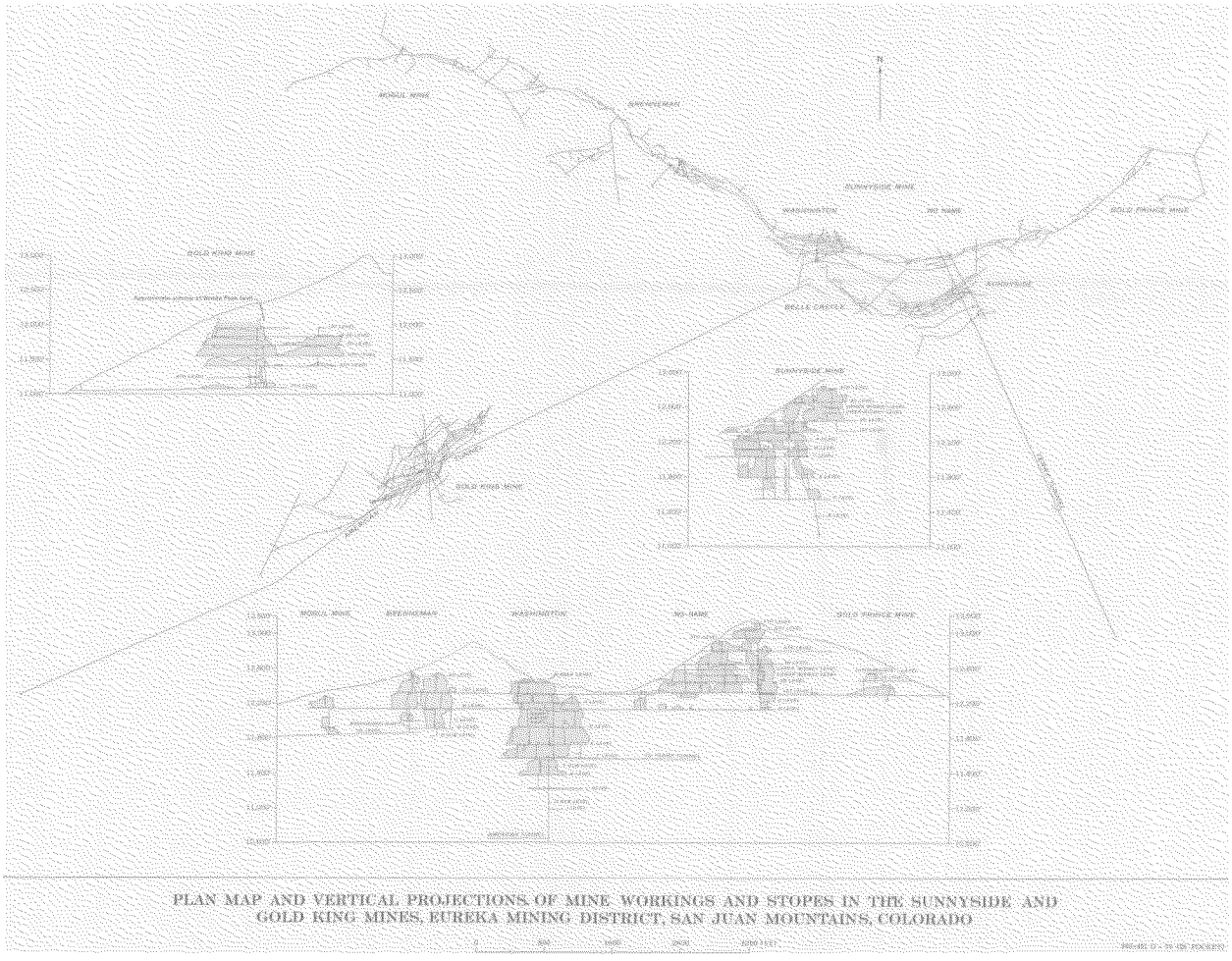

PLAN MAP AND VERTICAL PROJECTIONS OF MINE WORKINGS AND STOPES IN THE SUNNYSIDE AND
GOLD KING MINES, EUREKA MINING DISTRICT, SAN JUAN MOUNTAINS, COLORADO

Figure 4

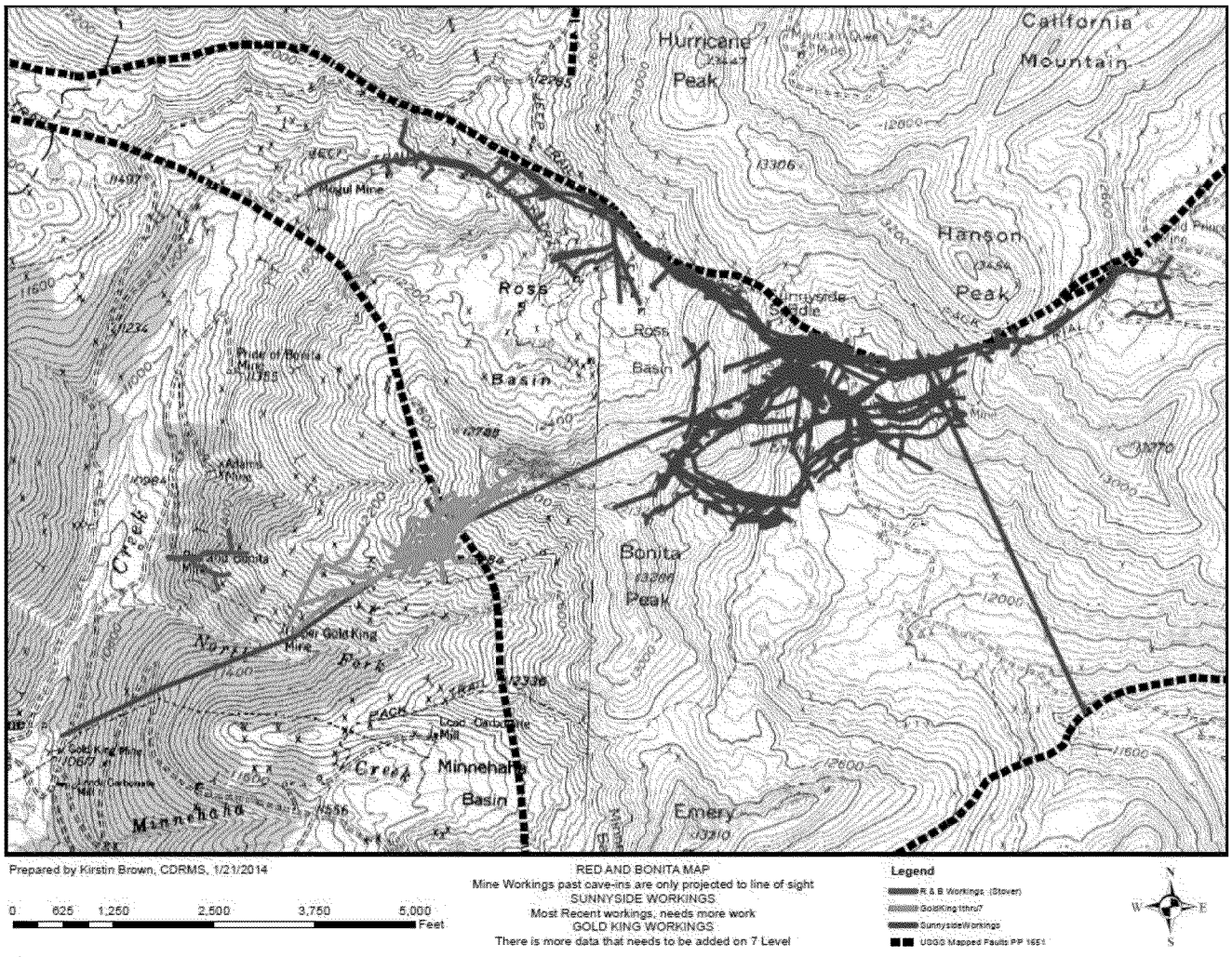

Hurricane Peak
California Mountain
Hanson Peak
Ross Basin
Sunnyside Saddle
Bonita Peak
Minnehaha Basin
Emery
Prepared by Kirstin Brown, CDRMS, 1/21/2014
RED AND BONITA MAP
Mine Workings past cave-ins are only projected to line of sight
SUNNYSIDE WORKINGS
Most Recent workings, needs more work
GOLD KING WORKINGS
There is more data that needs to be added on 7 Level
0 625 1,250 2,500 3,750 5,000 Feet
Legend
R & B Workings (Stover)
GoldKing1thru7
SunnysideWorkings
USGS Mapped Faults PP 1651
N
W
E
S

Figure 5

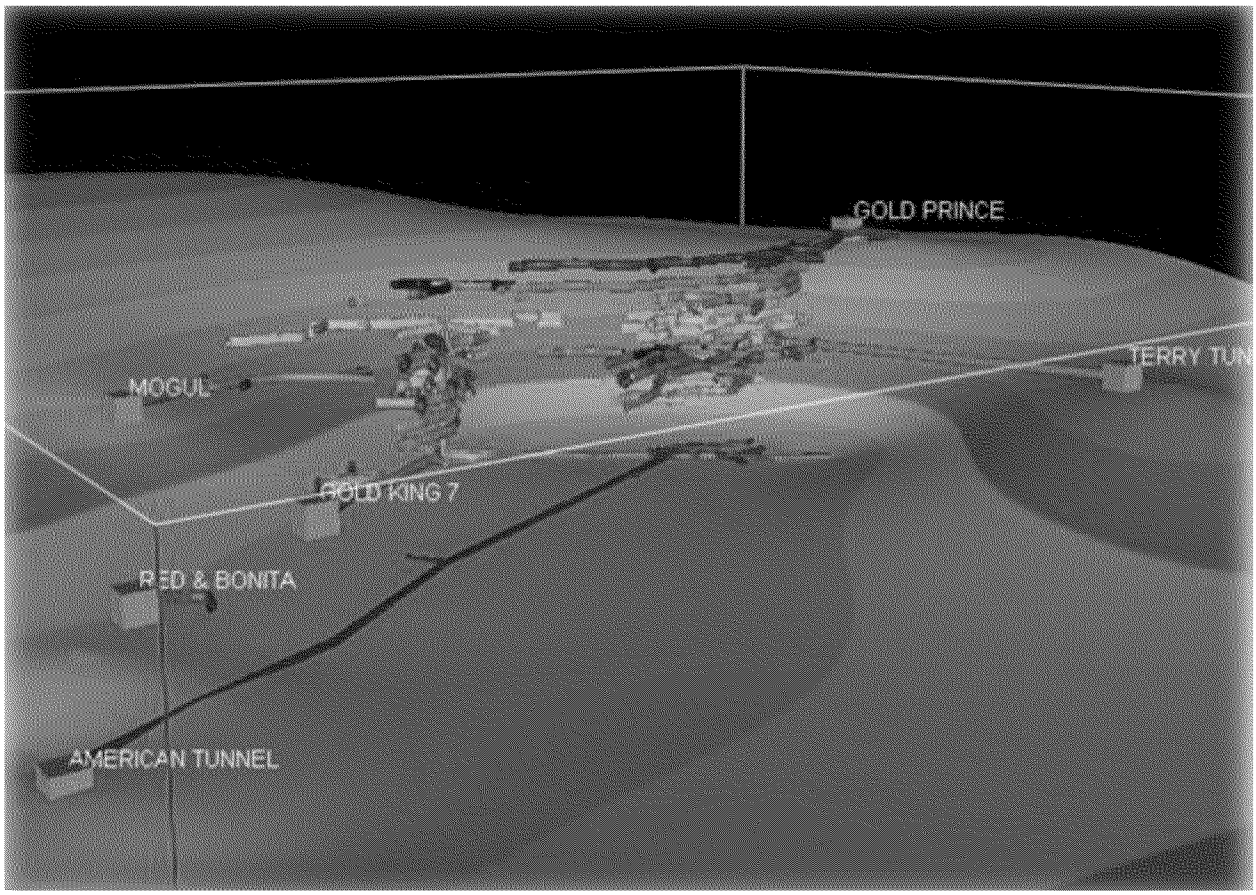

GOLD PRINCE
MOGUL
TERRY TUN
GOLD KING 7
RED & BONITA
AMERICAN TUNNEL

Figure 6

COLORADO
Division of Reclamation, Mining and Safety
Department of Natural Resources

1313 Sherman Street, Room 215
Denver, CO 80203

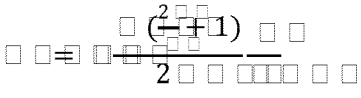
DATE: November 11, 2014

BY: Allen Sorenson

RE: ***Packer Testing Results, Red and Bonita Mine, San Juan County Colorado***

Reconnaissance and mapping of the underground workings of the Red and Bonita mine conducted during 2012 and 2013 identified a location 265 feet inby the mine portal as the ideal location for a water impounding concrete bulkhead (DRMS, 2014). The rock at this location is intensely jointed, and although the joints are tight, it was determined that packer testing to determine the permeability of the joint system was a prudent step in the bulkhead feasibility evaluation. On September 9 and 10, 2014, four packer test holes were drilled into the north and south ribs of the mine near the proposed bulkhead location, and packer testing conducted in each hole. The northeast and southeast holes took negligible amounts of water during packer testing, demonstrating that the rock at the hole locations is essentially impermeable. The Secondary Permeability Indices for the northwest and southwest holes are calculated as follows.

Secondary Permeability Index (SPI) equation (Azimian, 2013):



Where:

C is a constant = 1.49×10^{-10}
l = length of test section in meters
r = radius of test hole in meters
Q = volume of water take during test in liters
t = duration of test in seconds
H = water pressure in meters of head

For the southwest packer test hole:

l = 7 ft. = 2.13 m.
r = 1 in. = 0.0254 m.

Q = 1.15 gal. = 4.35 l.
t = 900 s.
H = 98 psi = 68.92 m.

$$K = 1.49 \times 10^{-10} \frac{\ln(\frac{2 \times 2.13}{0.0254} + 1)}{2 \times 2.13} \frac{4.35}{68.92 \times 900} = 4.00 \times 10^{-15}$$

For the northwest packer test hole:

l = 7 ft. = 2.13 m.
r = 1 in. = 0.0254 m.
Q = 4.46 gal. = 16.88 l.
t = 900 s.
H = 99 psi = 69.62 m.

$$K = 1.49 \times 10^{-10} \frac{\ln(\frac{2 \times 2.13}{0.0254} + 1)}{2 \times 2.13} \frac{16.88}{69.62 \times 900} = 1.54 \times 10^{-14}$$

Azimian (2013) defines the following classes of rock based on SPI.

Class A: If rock permeability (based on SPI) is 2.16×10^{-14} l/s.m^2 or less, it is placed in class A, impermeable and the best class of rock that does not need improvement.

Class B: If the permeability is in the following ranges, $2.16 \times 10^{-14} \leq SPI \leq 1.72 \times 10^{-13}$ l/s.m^2 permeability is low and only local improvement may be needed.

Class C: If the permeability is in the following ranges, $1.72 \times 10^{-13} \leq SPI \leq 1.72 \times 10^{-12}$ l/s m^2, rock improvement is indicated.

Class D: If the permeability (based on SPI) is greater than 1.72×10^{-12} l/s.m^2 the rock needs to be widely improved.

The rock penetrated by the packer test holes in the Red and Bonita falls into Class A. Based on these results and the proximity of a free rock face to the test locations, formation grouting prior to bulkhead installation will not be necessary.

References:

Azimian, A. and Ajalloeian, R., 2013, "Comparison between Lugeon with Secondary Permeability Index obtained of Water Pressure Test in Rock Masses," in Electronic Journal of Geotechnical Engineering, Volume 18.

Colorado Division of Reclamation, Mining & Safety (DRMS). 2014. "Preliminary Evaluation of Feasibility for Water Impounding Concrete Bulkheads, Red and Bonita Mine, San Juan County Colorado." August 19, 2014.

APPENDIX D
PACKER TEST

Packer Test Method
Red and Bonita Mine Site
September 2014

This document provides an overview for using a packer test to evaluate the in situ hydraulic permeability of the shallow rock in a mine. The equipment list and detailed procedure used for the cumulative packer test conducted in the Red & Bonita Mine during the week of September 8, 2014 are included. The results of the Red and Bonita test may be used to determine the suitability of a proposed bulkhead location and determine certain design requirements for a bulkhead that may be constructed to control or eliminate the flow of acidic water emanating from the mine.

Introduction

A packer test is conducted by inserting a plug (packer) into a borehole, injecting water behind the plug, and measuring the amount of water needed to maintain a steady pressure. A greater amount of water required indicates greater hydraulic conductivity than if only a small amount of water is required to maintain the pressure.

There are two single packer test procedures that can be effectively utilized to evaluate hydraulic permeability, cumulative and concurrent. Both tests involve drilling a borehole into the mine wall, inserting and setting a packer element, injecting water between the packer element and the borehole terminus, and measuring the flow of water required to maintain a given pressure. Cumulative tests are performed after the borehole has been drilled to the full depth, and concurrent tests are performed at iterative depths as the borehole is drilled. Both use the terminus of the borehole as the lower (deeper) boundary of the test interval and the packer element as the upper (shallower) boundary of the test interval. The benefit of the cumulative test is that all of the drilling can be done prior to testing; however, interpretation of test results can be confused by the presence of a single fracture or a small permeable zone. The benefit of the concurrent test is that a limited depth range is tested each time so the hydraulic conductivity of discrete depth zones can be determined; however, iterative drilling and testing operations must be conducted.

A cumulative test was used at the Red and Bonita Mine site.

Cumulative Packer Test Procedure

1. Drill a borehole into the rock to the full depth to be tested.

    a. The borehole diameter must be coordinated with the packer dimensions.

    b. The borehole depth is the full depth of interest, typically 10 to 12 feet but not greater than 20 feet. A longer borehole is more likely to encounter a few fractures or a relatively small zone that controls the groundwater flow.

    c. The orientation of the borehole relative to the fractures significantly affects the number of fractures intercepted by the hole and the perceived permeability. A vertical hole drilled in a material that has predominantly vertical fractures such as flat-bedded sediments will not

intercept the predominant control on the rock mass permeability. The drill holes should be oriented to cross as many fractures as possible not only for more meaningful permeability tests, but also to get meaningful rock mass design parameters.

2. Flush the borehole with clean water. Failing to adequately clean the hole may result in a permeable rock appearing to be impermeable because the borehole wall is sealed by cuttings or sediment.

3. Insert the packer element to a pre-determined depth. Typically, the test interval may be 10 feet long. Test intervals greater than 20 feet are inadvisable.

4. Inflate the packer gland to seal the element against the borehole wall.

5. Inject water under pressure into the void between the packer element and the terminus of the borehole while flow rates and pressures are recorded.

    a. The pressure is selected based on the rock being tested, the estimated permeability of the rock, and the expected intake of injected water.

6. Observe water injection flow rates and pressures until consistent readings are taken to represent steady-state flow.

The calculated permeability of the packer test interval may be a magnitude different from the actual rock mass permeability. Only in the case of a highly fractured rock mass is the calculated permeability relatively reliable and the result is still a relative or effective permeability.

Data Collection

The required data for each test includes:

- Radius of the hole
- Length of test section, the distance between the leading edge of the packer and the terminus of the borehole
- Depth, h_1, from gauge to the upper surface of the packer
- Applied pressure, h_2, at the gauge, in feet (meters)
- Steady flow into well at 5-minute intervals, in cubic feet per second (ft^3/sec) (cubic meters per second [m^3/sec])
- Nominal diameter and length of intake hose in feet between the gauge and packer
- Distance from the ground surface to the terminus of the test section, in feet (m)
- Time that the test is started and the time measurements are made

Packer Test Equipment and Setup

The packer is attached to an air system that is used to inflate the packer and seal it against the walls of the borehole and a water system that injects water behind the packer (Figure 1).

The air system consists of an SCBA air tank or nitrogen tank, regulator, supply hose, and connectors.

The water system consists of (starting at the source of water): water reservoir/tank, suction line, centrifugal or positive displacement pump, line to relief valve, 75 feet of line to water meter inlet pipe, shut off valve, water meter, gauge, line to packer, steel pipe, and packer. All connections should be kept as short and straight as possible, and the number of changes in hose and pipe diameter should be kept as small as possible. All joints, connections, and hose between the water meter and the packer or casing should be tight, and there should be no water leaks.

The following equipment is needed:

- Appropriate sized single packer unit (w/ 1 backup unit), 2 inch packer requires at least a 2.5 inch borehole, but no greater than 3.5 inches.
- Spare o-rings and fittings for unit (located with packer unit in warehouse)
- 1 inch brass or steel hose couplings for connecting packer assembly to hard pipe and water hose to any hard connections (relief valves, hard pipe, flow meter assembly) (with spares)
- 25 mm disk type water flow meter capable of 1 to 50 gpm, with an instantaneous flow indicator and a totalizer (located with packer unit in warehouse).
- Composite water line (Adapta Flex Red 1" ID). Make sure you have enough line to reach beyond the mine portal and to the water pump.
- Centrifugal pump (electric or gas) with minimum flow rate of at least 50 gpm up to 200 psi (take into consideration altitude of test, more power may be needed at high elevations). The pump must have intake and discharge hose as well as a split from the discharge to a 1 inch fitting.
- Air or nitrogen supply (w/ 1 backup unit). We used an SCBA tank.
- SCBA valves and regulators capable of reading and maintaining at least 200 psi pressure (located with packer unit in warehouse)
- Manifolds and all lines and fittings to attach SCBA regulator to packer airline (State of CO)
- Lighting
- Stop watch

Detailed Test Procedure

1. Drill holes to the correct diameter and depth.

    a. For the Red and Bonita test, the borehole diameter was approximately 2.25 inches with a maximum depth of approximately 10 feet. Note: The bore hole for a 2" packer cannot exceed 3.5" in diameter; however a larger hole (2.5 – 2.75) is better to provide more maneuverability inside the borehole.

2. Remove drilling mud and cuttings and flush with clear water.

3. Prepare single packer assembly with open bottom.

    a. Check inflation line connecting the packer and fittings – do not over tighten as the threads might be stripped.

    b. Check packer assembly for any leakage: Inflate to maximum gland working pressure in appropriate length and diameter of drill hole (200 psi for Red & Bonita test). Note: The packer is tested in an open environment to 500 psi so there is room to increase the psi during the test if needed.

4. Prepare and check the water feed system: water tank, pump (centrifugal or positive displacement pump with minimum 50 gallons per minute (gpm) and discharge pressure of at least 200 psi), connection hoses, pressure gauges (the ideal location for a pressure gauge is in the test section, as close to the packer as possible), valves and flow-meter.

5. Charge the water line by flushing water through the packer for a brief period of time.

6. Insert single packer assembly to pre-determined depth in bore hole (48 to 50 inches for the Red & Bonita test). A depth of 96 inches was not used due to the lack of permeability within the test area.

7. Inflate packer slowly (by 50 psi steps) until the working pressure has been reached. This will require filling to working pressure plus calculated hydrostatic pressure once the borehole is filled with water.

8. After inflation is complete, monitor the packer inflation line pressure for a minimum of 2 minutes to see if the air system is leaking.

9. When no air leaks are apparent, begin the test by opening the water feed system valve. Maintain constant initial pressure until it appears to have stabilized (often about 10-15 minutes). For the Red and Bonita test, water pressure was at 100 psi. Note: Problems with the packer system will be indicated by excessive water draining from the borehole or the packer removing itself from the borehole. This indicates that the water pressure in the borehole is overcoming the friction caused by the gland of the packer and that the air pressure in the packer is insufficient. Pre-tests will be run prior to testing to insure the packer system is functioning properly.

10. During this time, record the elapsed time and total volume of consumed water every 2 minutes in the log book.

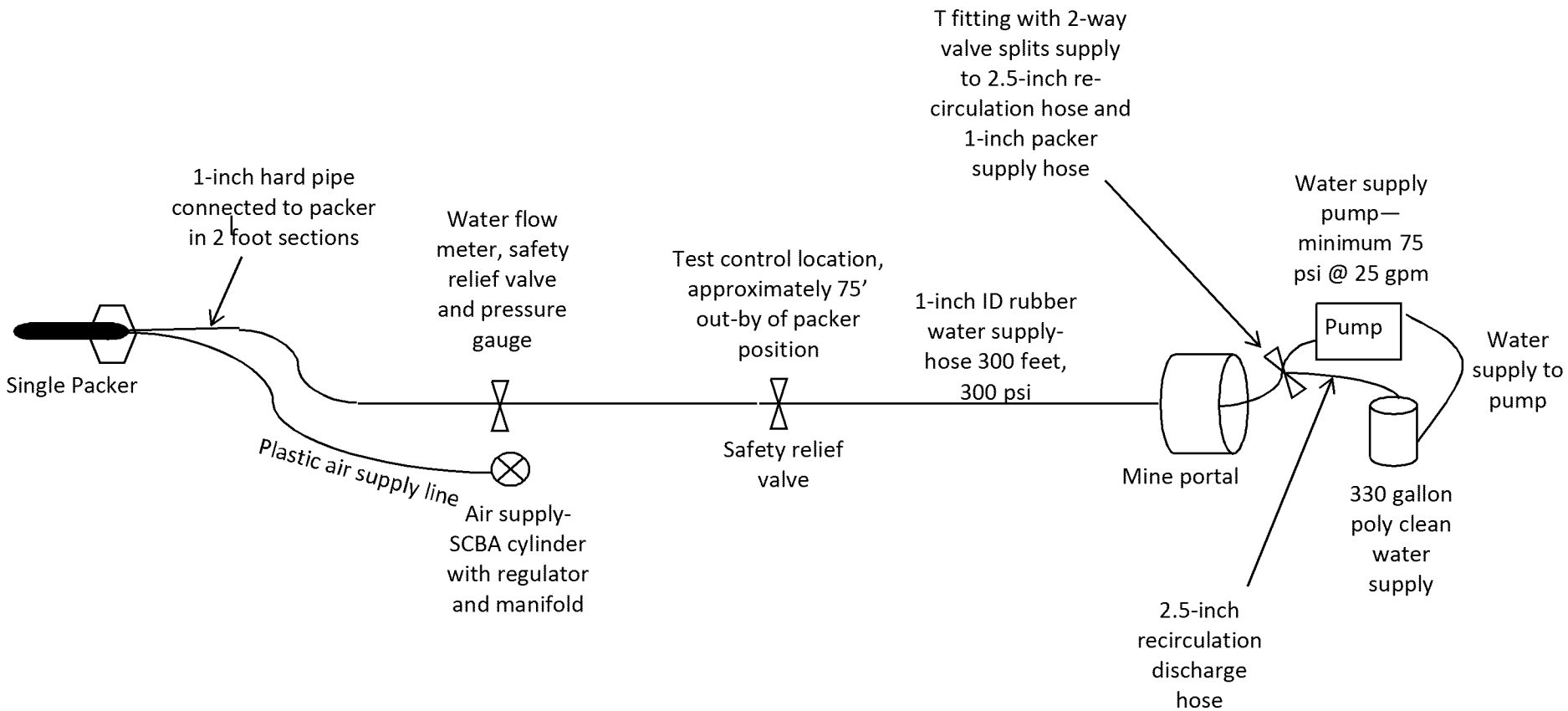
11. After 15 minutes of testing, note the elapsed time and total volume of consumed water, deflate packer assembly.

12. Wait until all air escapes from the packer cells and carefully pull the assembly out of the borehole.

13. One to two tests should be run in each borehole. The first test is performed at the shallower depth (closest to the opening of the borehole). If the first test shows low hydraulic conductivity (indicated by a low water requirement to maintain the given pressure), the entire hole has low hydraulic conductivity and the second test is unnecessary. If the first test shows high permeability, it is important to know if the permeable zone is shallow and/or deep, so a second test will be conducted with the packer at the deeper depth to determine the hydraulic conductivity of the deeper interval.

FIGURE 1

Packer Test Setup



W0023.2F.00133

APPENDIX E
LABORATORY ANALYTICAL RESULTS

U.S. Environmental Protection Agency
Region 8
Technical and Management Services

Laboratory Services Program

Certificate of Analysis

Ref: 8TMS-L

MEMORANDUM

Date: 09/13/13

Subject: Analytical Results--- **Red and Bonita Mine_Surface Water_AUG 2013_D382 / DG-382**

From: Don Goodrich; EPA Region8 Analytical Chemistry WAM

To: Steve Way
Superfund
1595 Wynkoop Street

Received Sample Set(s), [Work Order : Date Received]:
[C130809 : 08/16/2013]

Attached are the analytical results for the samples received from the Red and Bonita Mine_Surface Water_AUG 2013_D382 sampling event, according to TDF DG-382. All analyses were performed within their method specified holding times unless otherwise noted in the following narrative.

These samples were prepared, analyzed, and verified by the Environmental Services Assistance Team Laboratory (ESAT) according to the requirements of the Technical Direction Form(TDF).

Note: The laboratory herewith transmits this deliverable to the program/project partner for determination of "final data usability" which may include data validation and data quality asessment per and in accordance with EPA QA/G-8, *Guidance on Environmental Data Verification and Data Validation*, November 2002, EPA/240/R-02/004. Laboratory data qualifiers are applied based on the *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review,* October 2004, referred to as "NFGI".

Laboratory policy is to dispose of any remaining sample 60 days after data analysis packages are delivered to EPA. If you would like the laboratory to retain the samples for a period longer than 60 days, please contact Don Goodrich within the 60 day period at (303) 312-6687.

Case Narrative

C130809

Quality Assessment: Unless indicated by exception, the QA/QC associated with this sample set produced data within the TDF-specified criteria.

Holding Times: All samples were analyzed within their method-specified technical holding time(s).

1. Initial and Continuing calibration blanks (ICBs and CCBs).
   Exceptions: None.
2. Preparation (PB) / Method blanks (MB)
   Exceptions: None.
3. Interference Checks (ICSA / ICSAB) for ICP-MS and ICP-OE analyses only.
   Exceptions: In ICP-OE sequences 1309054 and 1309055, copper and cadmium fell outside acceptable limits. As a result, the reporting limits for copper and cadmium were raised to 3.0 ug/L and 6.0 ug/L, respectively. No qualifiers were assigned.
4. Initial and Continuing calibration verification analyses (ICVs and CCVs).
   Exceptions: None.
5. Laboratory Control Sample (LCS) or second source analysis or SRM.
   Exceptions: None.
6. Laboratory Fortified blank (LFB) / Blank spike (BS), same source as used for the matrix spikes.
   PBS performed with analyses/methods requiring preparation or digestion prior to analysis.
   Exceptions: In ICP-OE batch 1309045, arsenic recovered low in the BS. All samples were qualified "J" as estimated for arsenic.
7. Contract Reporting Detection Limit Standard, labeled as CRA, CRDL or CRL.
   Exceptions: None.
8. Laboratory Duplicate (DUP). "Source" identifies field sample duplicated in the laboratory. If either the "source" or the duplicate result is <5X the reporting limit, the %D limit of 20% does not apply.
   Exceptions: None.
9. Laboratory Matrix Spike (MS) and spike duplicate (MSD). "Source" defines original field sample fortified prior to analysis. Percent recovery (%R) limits do not apply when sample concentration(s) exceed the corresponding analyte spike level by a factor of 4 or greater.
   Exceptions: None.
10. Serial Dilution sample analysis (SRD). "Source" is parent field sample diluted 1:5 in the laboratory. Performed for ICP-OE and ICP-MS metals analyses. Percent difference (%D) limits do not apply when analyte concentration(s) are below 50x the source sample's MDL (or 10x it's PQL).
    Exceptions: None.
11. Internal standards, criteria specified for ICP-MS analyses only, monitored at the instrument.
    Exceptions: None.
12. Any calibration using more than two-points produced a correlation coefficient equal to or greater than 0.995.
    Exceptions: None.

Acronyms and Definitions:

ESAT	Environmental Services Assistance Team
J	Data Estimated qualifier (also applied to all data less than PQL, greater than or equal to MDL)
MDL	Method Detection Limit
PQL	Practical Quantitation Limit, also known as reporting limit.
RPD	Relative Percent Difference (difference divided by the mean)
%D	Percent difference, serial dilution criteria unit, difference divided by the original result
%R	Percent recovery, analyzed (less sample contribution) divided by true value
<	Analyte NOT DETECTED at or above the Method Detection Limit(MDL)
mg/L	Parts per million (millligrams per liter). Solids equivalent = mg/Kg.
ug/L	Parts per billion (micrograms per liter). Solids equivalent = ug/Kg.
NR	No Recovery (matrix spike) - Often seen for calcium/magnesium when their concentration exceeds the spike level by > 4x.
NFGI	*USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, October 2004
RE	Sample Re-analysis. Usually seen on raw data and sequences for required sample dilutions due to over-range analytes.
U	Analyte not detected at or above MDL qualifier
D	Diluted value qualifier.

Method(s) Summary :

As defined in the Technical Direction Form (TDF), some or all of the methods listed below were used for the determination of the reported target analytes.

From EPA's *Methods for the Determination of Metals in Environmental Samples*, Supplement I, May 1994, dissolved, total, and/or total recoverable metals were determined by:

- Method 200.7 / 6010B using a PE Optima ICP-OE (ICP).
- Method 200.8 / 6020 using a Perkin-Elmer Elan 6000 ICP-MS.
- Method 200.2 for total recoverable metals (only) digestion.
- Method 245.1 using a Perkin-Elmer FIMS CV AA (aqueous mercury only).

From *Standard Methods for the Examination of Water and Wastewater*, 18th Edition, 1992, Method 2340B was used for the calculated hardness determination. Hardness is reported as mg (milligram) equivalent $CaCO_3$ per liter (L) determined as follows:

Calculated hardness = 2.497 * (Calcium, mg/L) + 4.118 * (Magnesium, mg/L).

From *EPA's Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846*,

- Method 3015A was used for microwave assisted total metals digestion.
- Method 7473 was used for mercury in solids.

From EPA's *Determination of Inorganic Anions by Ion Chromatography*, Revision 2.1, 1993, Method 300.0 was used to determine the anions.

From EPA's *Methods for Chemical Analysis of Water and Wastes*, March 1983:

- Method 310.1 was followed for the alkalinity determination.
- Method 160.1 was followed for gravimetric total dissolved solids (TDS) determination.
- Method 160.2 was used for gravimetric total suspended solids (TSS) determination.
- Method 415.3 was used for total organic carbon (TOC) determination using either an Apollo 9000 or Phoenix 8000 Non-Dispersive IR (NDIR) system. Also known as dissolved organic carbon (DOC) when performed on the dissolved sample fraction.

The quality control procedures listed in the TDF request were utilized by ESAT to verify accuracy of the results and to evaluate any matrix interferences.

Project Name: Red and Bonita Mine_Surface Water_AUG 2013_D382 **Certificate of Analysis**

TDF #: DG-382

Metals (Dissolved) by EPA 200/7000 Series Methods

Station ID: RBMW01_08132013 **Date / Time Sampled:** 08/13/13 09:40 **Workorder:** C130809
EPA Tag No: 8-B **Matrix:** Surface Water **Lab Number:** C130809-02 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**11100**		ug/L	200	10	09/13/2013	SV	1309045
200.7	Antimony	< 1000	U	ug/L	500	10	09/13/2013	SV	1309045
200.7	Arsenic	< 1000	J,	ug/L	600	10	09/13/2013	SV	1309045
200.7	Barium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Beryllium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Cadmium**	**92.0**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Calcium**	**478000**		ug/L	500	10	09/13/2013	SV	1309045
200.7	Chromium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Cobalt**	**131**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Copper**	**30.1**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Iron**	**44700**		ug/L	1000	10	09/13/2013	SV	1309045
200.7	Lead	< 250	U	ug/L	100	10	09/13/2013	SV	1309045
200.7	**Magnesium**	**32400**		ug/L	1000	10	09/13/2013	SV	1309045
200.7	**Manganese**	**28400**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Molybdenum	< 200	U	ug/L	100	10	09/13/2013	SV	1309045
200.7	**Nickel**	**110**		ug/L	50.0	10	09/13/2013	SV	1309045
200.7	Potassium	< 10000	U	ug/L	2500	10	09/13/2013	SV	1309045
200.7	Selenium	< 1000	U	ug/L	600	10	09/13/2013	SV	1309045
200.7	Silver	< 100	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Sodium**	**9380**	J	ug/L	2500	10	09/13/2013	SV	1309045
200.7	**Strontium**	**5540**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Thallium	< 500	U	ug/L	200	10	09/13/2013	SV	1309045
200.7	Vanadium	< 500	U	ug/L	100	10	09/13/2013	SV	1309045
200.7	**Zinc**	**17400**		ug/L	100	10	09/13/2013	SV	1309045
2340B	**Hardness**	**1330**		mg/L	15	10	09/13/2013	SV	1309045

Project Name: Red and Bonita Mine_Surface Water_AUG 2013_D382 **Certificate of Analysis**

TDF #: DG-382

Metals (Dissolved) by EPA 200/7000 Series Methods

Station ID: RBMW02_08132013 **Date / Time Sampled:** 08/13/13 10:00 **Workorder:** C130809
EPA Tag No: 8-B **Matrix:** Surface Water **Lab Number:** C130809-04 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**3430**		ug/L	200	10	09/13/2013	SV	1309045
200.7	Antimony	< 1000	U	ug/L	500	10	09/13/2013	SV	1309045
200.7	Arsenic	< 1000	J,	ug/L	600	10	09/13/2013	SV	1309045
200.7	Barium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Beryllium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Cadmium**	**20.6**	J	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Calcium**	**437000**		ug/L	500	10	09/13/2013	SV	1309045
200.7	Chromium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Cobalt**	**120**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Copper	< 30.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Iron**	**75000**		ug/L	1000	10	09/13/2013	SV	1309045
200.7	Lead	< 250	U	ug/L	100	10	09/13/2013	SV	1309045
200.7	**Magnesium**	**25200**		ug/L	1000	10	09/13/2013	SV	1309045
200.7	**Manganese**	**35000**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Molybdenum	< 200	U	ug/L	100	10	09/13/2013	SV	1309045
200.7	**Nickel**	**77.7**	J	ug/L	50.0	10	09/13/2013	SV	1309045
200.7	Potassium	< 10000	U	ug/L	2500	10	09/13/2013	SV	1309045
200.7	Selenium	< 1000	U	ug/L	600	10	09/13/2013	SV	1309045
200.7	Silver	< 100	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Sodium**	**7680**	J	ug/L	2500	10	09/13/2013	SV	1309045
200.7	**Strontium**	**5040**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Thallium	< 500	U	ug/L	200	10	09/13/2013	SV	1309045
200.7	Vanadium	< 500	U	ug/L	100	10	09/13/2013	SV	1309045
200.7	**Zinc**	**16900**		ug/L	100	10	09/13/2013	SV	1309045
2340B	**Hardness**	**1200**		mg/L	15	10	09/13/2013	SV	1309045

Project Name: Red and Bonita Mine_Surface Water_AUG 2013_D382 **Certificate of Analysis**

TDF #: DG-382

Metals (Dissolved) by EPA 200/7000 Series Methods

Station ID: RBMW03_08132013 **Date / Time Sampled:** 08/13/13 11:00 **Workorder:** C130809
EPA Tag No: 8-B **Matrix:** Surface Water **Lab Number:** C130809-06 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**410**	J	ug/L	200	10	09/13/2013	SV	1309045
200.7	Antimony	< 1000	U	ug/L	500	10	09/13/2013	SV	1309045
200.7	Arsenic	< 1000	J,	ug/L	600	10	09/13/2013	SV	1309045
200.7	Barium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Beryllium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Cadmium	< 60.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Calcium**	**324000**		ug/L	500	10	09/13/2013	SV	1309045
200.7	Chromium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Cobalt**	**67.0**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Copper	< 30.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Iron**	**16700**		ug/L	1000	10	09/13/2013	SV	1309045
200.7	Lead	< 250	U	ug/L	100	10	09/13/2013	SV	1309045
200.7	**Magnesium**	**25800**		ug/L	1000	10	09/13/2013	SV	1309045
200.7	**Manganese**	**31700**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Molybdenum	< 200	U	ug/L	100	10	09/13/2013	SV	1309045
200.7	Nickel	< 100	U	ug/L	50.0	10	09/13/2013	SV	1309045
200.7	Potassium	< 10000	U	ug/L	2500	10	09/13/2013	SV	1309045
200.7	Selenium	< 1000	U	ug/L	600	10	09/13/2013	SV	1309045
200.7	Silver	< 100	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Sodium**	**9970**	J	ug/L	2500	10	09/13/2013	SV	1309045
200.7	**Strontium**	**3490**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Thallium	< 500	U	ug/L	200	10	09/13/2013	SV	1309045
200.7	Vanadium	< 500	U	ug/L	100	10	09/13/2013	SV	1309045
200.7	**Zinc**	**6350**		ug/L	100	10	09/13/2013	SV	1309045
2340B	**Hardness**	**916**		mg/L	15	10	09/13/2013	SV	1309045

Project Name: Red and Bonita Mine_Surface Water_AUG 2013_D382 **Certificate of Analysis**

TDF #: DG-382

Metals (Dissolved) by EPA 200/7000 Series Methods

Station ID: RBSW01_08072013 **Date / Time Sampled:** 08/07/13 08:15 **Workorder:** C130809
EPA Tag No: 8-B **Matrix:** Surface Water **Lab Number:** C130809-08 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**4840**		ug/L	200	10	09/13/2013	SV	1309045
200.7	Antimony	< 1000	U	ug/L	500	10	09/13/2013	SV	1309045
200.7	Arsenic	< 1000	J,	ug/L	600	10	09/13/2013	SV	1309045
200.7	Barium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Beryllium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Cadmium**	**30.5**	J	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Calcium**	**425000**		ug/L	500	10	09/13/2013	SV	1309045
200.7	Chromium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Cobalt**	**119**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Copper**	**50.4**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Iron**	**90400**		ug/L	1000	10	09/13/2013	SV	1309045
200.7	**Lead**	**131**	J	ug/L	100	10	09/13/2013	SV	1309045
200.7	**Magnesium**	**26000**		ug/L	1000	10	09/13/2013	SV	1309045
200.7	**Manganese**	**33600**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Molybdenum	< 200	U	ug/L	100	10	09/13/2013	SV	1309045
200.7	**Nickel**	**84.6**	J	ug/L	50.0	10	09/13/2013	SV	1309045
200.7	Potassium	< 10000	U	ug/L	2500	10	09/13/2013	SV	1309045
200.7	Selenium	< 1000	U	ug/L	600	10	09/13/2013	SV	1309045
200.7	Silver	< 100	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Sodium**	**7980**	J	ug/L	2500	10	09/13/2013	SV	1309045
200.7	**Strontium**	**4850**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Thallium	< 500	U	ug/L	200	10	09/13/2013	SV	1309045
200.7	Vanadium	< 500	U	ug/L	100	10	09/13/2013	SV	1309045
200.7	**Zinc**	**16000**		ug/L	100	10	09/13/2013	SV	1309045
2340B	**Hardness**	**1170**		mg/L	15	10	09/13/2013	SV	1309045

Metals (Dissolved) by EPA 200/7000 Series Methods

Station ID: RBSW02_08092013 **Date / Time Sampled:** 08/09/13 18:10 **Workorder:** C130809
EPA Tag No: 8-B **Matrix:** Surface Water **Lab Number:** C130809-10 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**2220**		ug/L	200	10	09/13/2013	SV	1309045
200.7	Antimony	< 1000	U	ug/L	500	10	09/13/2013	SV	1309045
200.7	Arsenic	< 1000	J,	ug/L	600	10	09/13/2013	SV	1309045
200.7	Barium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Beryllium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Cadmium**	**39.6**	J	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Calcium**	**422000**		ug/L	500	10	09/13/2013	SV	1309045
200.7	Chromium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Cobalt**	**114**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Copper**	**37.6**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Iron**	**63200**		ug/L	1000	10	09/13/2013	SV	1309045
200.7	Lead	< 250	U	ug/L	100	10	09/13/2013	SV	1309045
200.7	**Magnesium**	**25800**		ug/L	1000	10	09/13/2013	SV	1309045
200.7	**Manganese**	**32300**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Molybdenum	< 200	U	ug/L	100	10	09/13/2013	SV	1309045
200.7	**Nickel**	**82.4**	J	ug/L	50.0	10	09/13/2013	SV	1309045
200.7	Potassium	< 10000	U	ug/L	2500	10	09/13/2013	SV	1309045
200.7	Selenium	< 1000	U	ug/L	600	10	09/13/2013	SV	1309045
200.7	Silver	< 100	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Sodium**	**57200**		ug/L	2500	10	09/13/2013	SV	1309045
200.7	**Strontium**	**4740**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Thallium	< 500	U	ug/L	200	10	09/13/2013	SV	1309045
200.7	Vanadium	< 500	U	ug/L	100	10	09/13/2013	SV	1309045
200.7	**Zinc**	**15600**		ug/L	100	10	09/13/2013	SV	1309045
2340B	**Hardness**	**1160**		mg/L	15	10	09/13/2013	SV	1309045

Metals (Dissolved) by EPA 200/7000 Series Methods

Station ID: RBSW02_08142013 **Date / Time Sampled:** 08/14/13 12:30 **Workorder:** C130809
EPA Tag No: 8-B **Matrix:** Surface Water **Lab Number:** C130809-12 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**371**	J	ug/L	200	10	09/13/2013	SV	1309045
200.7	Antimony	< 1000	U	ug/L	500	10	09/13/2013	SV	1309045
200.7	Arsenic	< 1000	J,	ug/L	600	10	09/13/2013	SV	1309045
200.7	Barium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Beryllium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Cadmium**	**24.2**	J	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Calcium**	**427000**		ug/L	500	10	09/13/2013	SV	1309045
200.7	Chromium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Cobalt**	**83.7**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Copper	< 30.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Iron**	**38000**		ug/L	1000	10	09/13/2013	SV	1309045
200.7	Lead	< 250	U	ug/L	100	10	09/13/2013	SV	1309045
200.7	**Magnesium**	**25900**		ug/L	1000	10	09/13/2013	SV	1309045
200.7	**Manganese**	**32000**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Molybdenum	< 200	U	ug/L	100	10	09/13/2013	SV	1309045
200.7	**Nickel**	**58.8**	J	ug/L	50.0	10	09/13/2013	SV	1309045
200.7	Potassium	< 10000	U	ug/L	2500	10	09/13/2013	SV	1309045
200.7	**Selenium**	**610**	J	ug/L	600	10	09/13/2013	SV	1309045
200.7	Silver	< 100	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Sodium**	**79000**		ug/L	2500	10	09/13/2013	SV	1309045
200.7	**Strontium**	**4820**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Thallium	< 500	U	ug/L	200	10	09/13/2013	SV	1309045
200.7	Vanadium	< 500	U	ug/L	100	10	09/13/2013	SV	1309045
200.7	**Zinc**	**8740**		ug/L	100	10	09/13/2013	SV	1309045
2340B	**Hardness**	**1170**		mg/L	15	10	09/13/2013	SV	1309045

Metals (Dissolved) by EPA 200/7000 Series Methods

Station ID: RBSW03_08072013 **Date / Time Sampled:** 08/07/13 08:55 **Workorder:** C130809
EPA Tag No: 8-B **Matrix:** Surface Water **Lab Number:** C130809-14 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**3130**		ug/L	200	10	09/13/2013	SV	1309045
200.7	Antimony	< 1000	U	ug/L	500	10	09/13/2013	SV	1309045
200.7	Arsenic	< 1000	J,	ug/L	600	10	09/13/2013	SV	1309045
200.7	**Barium**	**20.0**	J	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Beryllium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Cadmium	< 60.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Calcium**	**129000**		ug/L	500	10	09/13/2013	SV	1309045
200.7	Chromium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Cobalt**	**27.4**	J	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Copper**	**140**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Iron**	**15500**		ug/L	1000	10	09/13/2013	SV	1309045
200.7	Lead	< 250	U	ug/L	100	10	09/13/2013	SV	1309045
200.7	**Magnesium**	**10100**		ug/L	1000	10	09/13/2013	SV	1309045
200.7	**Manganese**	**9140**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Molybdenum	< 200	U	ug/L	100	10	09/13/2013	SV	1309045
200.7	Nickel	< 100	U	ug/L	50.0	10	09/13/2013	SV	1309045
200.7	Potassium	< 10000	U	ug/L	2500	10	09/13/2013	SV	1309045
200.7	Selenium	< 1000	U	ug/L	600	10	09/13/2013	SV	1309045
200.7	Silver	< 100	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Sodium**	**3030**	J	ug/L	2500	10	09/13/2013	SV	1309045
200.7	**Strontium**	**1350**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Thallium	< 500	U	ug/L	200	10	09/13/2013	SV	1309045
200.7	Vanadium	< 500	U	ug/L	100	10	09/13/2013	SV	1309045
200.7	**Zinc**	**5590**		ug/L	100	10	09/13/2013	SV	1309045
2340B	**Hardness**	**365**		mg/L	15	10	09/13/2013	SV	1309045

Project Name: Red and Bonita Mine_Surface Water_AUG 2013_D382 **Certificate of Analysis**

TDF #: DG-382

Metals (Dissolved) by EPA 200/7000 Series Methods

Station ID: RBSW03_08142013 **Date / Time Sampled:** 08/14/13 15:40 **Workorder:** C130809
EPA Tag No: 8-B **Matrix:** Surface Water **Lab Number:** C130809-16 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**3940**		ug/L	200	10	09/13/2013	SV	1309045
200.7	Antimony	< 1000	U	ug/L	500	10	09/13/2013	SV	1309045
200.7	Arsenic	< 1000	J,	ug/L	600	10	09/13/2013	SV	1309045
200.7	Barium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Beryllium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Cadmium**	**31.3**	J	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Calcium**	**417000**		ug/L	500	10	09/13/2013	SV	1309045
200.7	Chromium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Cobalt**	**110**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Copper	< 30.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Iron**	**55600**		ug/L	1000	10	09/13/2013	SV	1309045
200.7	Lead	< 250	U	ug/L	100	10	09/13/2013	SV	1309045
200.7	**Magnesium**	**25700**		ug/L	1000	10	09/13/2013	SV	1309045
200.7	**Manganese**	**33200**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Molybdenum	< 200	U	ug/L	100	10	09/13/2013	SV	1309045
200.7	**Nickel**	**72.3**	J	ug/L	50.0	10	09/13/2013	SV	1309045
200.7	Potassium	< 10000	U	ug/L	2500	10	09/13/2013	SV	1309045
200.7	Selenium	< 1000	U	ug/L	600	10	09/13/2013	SV	1309045
200.7	Silver	< 100	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Sodium**	**8040**	J	ug/L	2500	10	09/13/2013	SV	1309045
200.7	**Strontium**	**4820**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Thallium	< 500	U	ug/L	200	10	09/13/2013	SV	1309045
200.7	Vanadium	< 500	U	ug/L	100	10	09/13/2013	SV	1309045
200.7	**Zinc**	**15600**		ug/L	100	10	09/13/2013	SV	1309045
2340B	**Hardness**	**1150**		mg/L	15	10	09/13/2013	SV	1309045

Metals (Dissolved) by EPA 200/7000 Series Methods

Station ID: RBSW99_08092013 **Date / Time Sampled:** 08/09/13 18:10 **Workorder:** C130809
EPA Tag No: 8-B **Matrix:** Surface Water **Lab Number:** C130809-18 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**2240**		ug/L	200	10	09/13/2013	SV	1309045
200.7	Antimony	< 1000	U	ug/L	500	10	09/13/2013	SV	1309045
200.7	Arsenic	< 1000	J,	ug/L	600	10	09/13/2013	SV	1309045
200.7	Barium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Beryllium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Cadmium**	**37.1**	J	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Calcium**	**414000**		ug/L	500	10	09/13/2013	SV	1309045
200.7	Chromium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Cobalt**	**107**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Copper**	**41.8**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Iron**	**60200**		ug/L	1000	10	09/13/2013	SV	1309045
200.7	Lead	< 250	U	ug/L	100	10	09/13/2013	SV	1309045
200.7	**Magnesium**	**25700**		ug/L	1000	10	09/13/2013	SV	1309045
200.7	**Manganese**	**31800**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Molybdenum	< 200	U	ug/L	100	10	09/13/2013	SV	1309045
200.7	**Nickel**	**80.4**	J	ug/L	50.0	10	09/13/2013	SV	1309045
200.7	Potassium	< 10000	U	ug/L	2500	10	09/13/2013	SV	1309045
200.7	**Selenium**	**704**	J	ug/L	600	10	09/13/2013	SV	1309045
200.7	Silver	< 100	U	ug/L	20.0	10	09/13/2013	SV	1309045
200.7	**Sodium**	**57300**		ug/L	2500	10	09/13/2013	SV	1309045
200.7	**Strontium**	**4700**		ug/L	20.0	10	09/13/2013	SV	1309045
200.7	Thallium	< 500	U	ug/L	200	10	09/13/2013	SV	1309045
200.7	Vanadium	< 500	U	ug/L	100	10	09/13/2013	SV	1309045
200.7	**Zinc**	**15400**		ug/L	100	10	09/13/2013	SV	1309045
2340B	**Hardness**	**1140**		mg/L	15	10	09/13/2013	SV	1309045

"J" Qualifier indicates an estimated value

Metals (Total Recov) by EPA 200/7000 Series Methods

Station ID: RBMW01_08132013 **Date / Time Sampled:** 08/13/13 09:40 **Workorder:** C130809
EPA Tag No: 8-A **Matrix:** Surface Water **Lab Number:** C130809-01 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**11400**		ug/L	200	10	09/13/2013	SV	1309028
200.7	Antimony	< 1000	U	ug/L	500	10	09/13/2013	SV	1309028
200.7	Arsenic	< 1000	U	ug/L	600	10	09/13/2013	SV	1309028
200.7	Barium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Beryllium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Cadmium**	**91.6**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Calcium**	**478000**		ug/L	500	10	09/13/2013	SV	1309028
200.7	Chromium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Cobalt**	**126**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Copper**	**33.7**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Iron**	**87100**		ug/L	1000	10	09/13/2013	SV	1309028
200.7	Lead	< 250	U	ug/L	100	10	09/13/2013	SV	1309028
200.7	**Magnesium**	**32600**		ug/L	1000	10	09/13/2013	SV	1309028
200.7	**Manganese**	**28400**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Molybdenum**	**107**	J	ug/L	100	10	09/13/2013	SV	1309028
200.7	**Nickel**	**89.0**	J	ug/L	50.0	10	09/13/2013	SV	1309028
200.7	Potassium	< 10000	U	ug/L	2500	10	09/13/2013	SV	1309028
200.7	Selenium	< 1000	U	ug/L	600	10	09/13/2013	SV	1309028
200.7	Silver	< 100	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Sodium**	**9550**	J	ug/L	2500	10	09/13/2013	SV	1309028
200.7	**Strontium**	**5550**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Thallium	< 500	U	ug/L	200	10	09/13/2013	SV	1309028
200.7	Vanadium	< 500	U	ug/L	100	10	09/13/2013	SV	1309028
200.7	**Zinc**	**17500**		ug/L	100	10	09/13/2013	SV	1309028

Metals (Total Recov) by EPA 200/7000 Series Methods

Station ID: RBMW02_08132013 **Date / Time Sampled:** 08/13/13 10:00 **Workorder:** C130809
EPA Tag No: 8-A **Matrix:** Surface Water **Lab Number:** C130809-03 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**3760**		ug/L	200	10	09/13/2013	SV	1309028
200.7	Antimony	< 1000	U	ug/L	500	10	09/13/2013	SV	1309028
200.7	Arsenic	< 1000	U	ug/L	600	10	09/13/2013	SV	1309028
200.7	Barium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Beryllium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Cadmium	< 60.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Calcium**	**446000**		ug/L	500	10	09/13/2013	SV	1309028
200.7	Chromium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Cobalt**	**113**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Copper	< 30.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Iron**	**98700**		ug/L	1000	10	09/13/2013	SV	1309028
200.7	Lead	< 250	U	ug/L	100	10	09/13/2013	SV	1309028
200.7	**Magnesium**	**25700**		ug/L	1000	10	09/13/2013	SV	1309028
200.7	**Manganese**	**35400**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Molybdenum	< 200	U	ug/L	100	10	09/13/2013	SV	1309028
200.7	**Nickel**	**79.0**	J	ug/L	50.0	10	09/13/2013	SV	1309028
200.7	**Potassium**	**2760**	J	ug/L	2500	10	09/13/2013	SV	1309028
200.7	Selenium	< 1000	U	ug/L	600	10	09/13/2013	SV	1309028
200.7	Silver	< 100	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Sodium**	**7920**	J	ug/L	2500	10	09/13/2013	SV	1309028
200.7	**Strontium**	**5160**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Thallium	< 500	U	ug/L	200	10	09/13/2013	SV	1309028
200.7	Vanadium	< 500	U	ug/L	100	10	09/13/2013	SV	1309028
200.7	**Zinc**	**17100**		ug/L	100	10	09/13/2013	SV	1309028

Metals (Total Recov) by EPA 200/7000 Series Methods

Station ID: RBMW03_08132013 **Date / Time Sampled:** 08/13/13 11:00 **Workorder:** C130809
EPA Tag No: 8-A **Matrix:** Surface Water **Lab Number:** C130809-05 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**399**	J	ug/L	200	10	09/13/2013	SV	1309028
200.7	Antimony	< 1000	U	ug/L	500	10	09/13/2013	SV	1309028
200.7	Arsenic	< 1000	U	ug/L	600	10	09/13/2013	SV	1309028
200.7	Barium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Beryllium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Cadmium	< 60.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Calcium**	**329000**		ug/L	500	10	09/13/2013	SV	1309028
200.7	Chromium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Cobalt**	**62.7**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Copper**	**21.3**	J	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Iron**	**72800**		ug/L	1000	10	09/13/2013	SV	1309028
200.7	Lead	< 250	U	ug/L	100	10	09/13/2013	SV	1309028
200.7	**Magnesium**	**26300**		ug/L	1000	10	09/13/2013	SV	1309028
200.7	**Manganese**	**32300**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Molybdenum	< 200	U	ug/L	100	10	09/13/2013	SV	1309028
200.7	Nickel	< 100	U	ug/L	50.0	10	09/13/2013	SV	1309028
200.7	Potassium	< 10000	U	ug/L	2500	10	09/13/2013	SV	1309028
200.7	Selenium	< 1000	U	ug/L	600	10	09/13/2013	SV	1309028
200.7	Silver	< 100	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Sodium**	**10300**		ug/L	2500	10	09/13/2013	SV	1309028
200.7	**Strontium**	**3550**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Thallium	< 500	U	ug/L	200	10	09/13/2013	SV	1309028
200.7	Vanadium	< 500	U	ug/L	100	10	09/13/2013	SV	1309028
200.7	**Zinc**	**6520**		ug/L	100	10	09/13/2013	SV	1309028

Metals (Total Recov) by EPA 200/7000 Series Methods

Station ID: RBSW01_08072013 **Date / Time Sampled:** 08/07/13 08:15 **Workorder:** C130809
EPA Tag No: 8-A **Matrix:** Surface Water **Lab Number:** C130809-07 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**5950**		ug/L	200	10	09/13/2013	SV	1309028
200.7	Antimony	< 1000	U	ug/L	500	10	09/13/2013	SV	1309028
200.7	Arsenic	< 1000	U	ug/L	600	10	09/13/2013	SV	1309028
200.7	Barium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Beryllium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Cadmium**	**31.3**	J	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Calcium**	**417000**		ug/L	500	10	09/13/2013	SV	1309028
200.7	Chromium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Cobalt**	**108**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Copper**	**76.5**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Iron**	**93300**		ug/L	1000	10	09/13/2013	SV	1309028
200.7	**Lead**	**290**		ug/L	100	10	09/13/2013	SV	1309028
200.7	**Magnesium**	**26000**		ug/L	1000	10	09/13/2013	SV	1309028
200.7	**Manganese**	**33300**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Molybdenum	< 200	U	ug/L	100	10	09/13/2013	SV	1309028
200.7	**Nickel**	**73.0**	J	ug/L	50.0	10	09/13/2013	SV	1309028
200.7	Potassium	< 10000	U	ug/L	2500	10	09/13/2013	SV	1309028
200.7	**Selenium**	**917**	J	ug/L	600	10	09/13/2013	SV	1309028
200.7	Silver	< 100	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Sodium**	**8170**	J	ug/L	2500	10	09/13/2013	SV	1309028
200.7	**Strontium**	**4870**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Thallium	< 500	U	ug/L	200	10	09/13/2013	SV	1309028
200.7	Vanadium	< 500	U	ug/L	100	10	09/13/2013	SV	1309028
200.7	**Zinc**	**15900**		ug/L	100	10	09/13/2013	SV	1309028

Metals (Total Recov) by EPA 200/7000 Series Methods

Station ID: RBSW02_08092013 **Date / Time Sampled:** 08/09/13 18:10 **Workorder:** C130809
EPA Tag No: 8-A **Matrix:** Surface Water **Lab Number:** C130809-09 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**2260**		ug/L	200	10	09/13/2013	SV	1309028
200.7	Antimony	< 1000	U	ug/L	500	10	09/13/2013	SV	1309028
200.7	Arsenic	< 1000	U	ug/L	600	10	09/13/2013	SV	1309028
200.7	Barium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Beryllium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Cadmium**	**37.7**	J	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Calcium**	**419000**		ug/L	500	10	09/13/2013	SV	1309028
200.7	Chromium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Cobalt**	**107**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Copper**	**34.0**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Iron**	**61500**		ug/L	1000	10	09/13/2013	SV	1309028
200.7	Lead	< 250	U	ug/L	100	10	09/13/2013	SV	1309028
200.7	**Magnesium**	**25900**		ug/L	1000	10	09/13/2013	SV	1309028
200.7	**Manganese**	**32200**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Molybdenum	< 200	U	ug/L	100	10	09/13/2013	SV	1309028
200.7	**Nickel**	**67.8**	J	ug/L	50.0	10	09/13/2013	SV	1309028
200.7	Potassium	< 10000	U	ug/L	2500	10	09/13/2013	SV	1309028
200.7	Selenium	< 1000	U	ug/L	600	10	09/13/2013	SV	1309028
200.7	Silver	< 100	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Sodium**	**58200**		ug/L	2500	10	09/13/2013	SV	1309028
200.7	**Strontium**	**4730**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Thallium	< 500	U	ug/L	200	10	09/13/2013	SV	1309028
200.7	Vanadium	< 500	U	ug/L	100	10	09/13/2013	SV	1309028
200.7	**Zinc**	**15300**		ug/L	100	10	09/13/2013	SV	1309028

Metals (Total Recov) by EPA 200/7000 Series Methods

Station ID: RBSW02_08142013 **Date / Time Sampled:** 08/14/13 12:30 **Workorder:** C130809
EPA Tag No: 8-A **Matrix:** Surface Water **Lab Number:** C130809-11 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**429**	J	ug/L	200	10	09/13/2013	SV	1309028
200.7	Antimony	< 1000	U	ug/L	500	10	09/13/2013	SV	1309028
200.7	Arsenic	< 1000	U	ug/L	600	10	09/13/2013	SV	1309028
200.7	Barium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Beryllium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Cadmium**	**21.0**	J	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Calcium**	**417000**		ug/L	500	10	09/13/2013	SV	1309028
200.7	Chromium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Cobalt**	**90.6**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Copper	< 30.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Iron**	**40600**		ug/L	1000	10	09/13/2013	SV	1309028
200.7	Lead	< 250	U	ug/L	100	10	09/13/2013	SV	1309028
200.7	**Magnesium**	**25600**		ug/L	1000	10	09/13/2013	SV	1309028
200.7	**Manganese**	**31500**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Molybdenum	< 200	U	ug/L	100	10	09/13/2013	SV	1309028
200.7	**Nickel**	**57.9**	J	ug/L	50.0	10	09/13/2013	SV	1309028
200.7	Potassium	< 10000	U	ug/L	2500	10	09/13/2013	SV	1309028
200.7	Selenium	< 1000	U	ug/L	600	10	09/13/2013	SV	1309028
200.7	Silver	< 100	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Sodium**	**78600**		ug/L	2500	10	09/13/2013	SV	1309028
200.7	**Strontium**	**4780**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Thallium	< 500	U	ug/L	200	10	09/13/2013	SV	1309028
200.7	Vanadium	< 500	U	ug/L	100	10	09/13/2013	SV	1309028
200.7	**Zinc**	**8600**		ug/L	100	10	09/13/2013	SV	1309028

Metals (Total Recov) by EPA 200/7000 Series Methods

Station ID: RBSW03_08072013 **Date / Time Sampled:** 08/07/13 08:55 **Workorder:** C130809
EPA Tag No: 8-A **Matrix:** Surface Water **Lab Number:** C130809-13 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**2800**		ug/L	200	10	09/13/2013	SV	1309028
200.7	Antimony	< 1000	U	ug/L	500	10	09/13/2013	SV	1309028
200.7	Arsenic	< 1000	U	ug/L	600	10	09/13/2013	SV	1309028
200.7	**Barium**	**21.0**	J	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Beryllium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Cadmium	< 60.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Calcium**	**130000**		ug/L	500	10	09/13/2013	SV	1309028
200.7	Chromium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Cobalt**	**24.8**	J	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Copper**	**144**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Iron**	**15700**		ug/L	1000	10	09/13/2013	SV	1309028
200.7	Lead	< 250	U	ug/L	100	10	09/13/2013	SV	1309028
200.7	**Magnesium**	**9970**		ug/L	1000	10	09/13/2013	SV	1309028
200.7	**Manganese**	**8950**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Molybdenum	< 200	U	ug/L	100	10	09/13/2013	SV	1309028
200.7	Nickel	< 100	U	ug/L	50.0	10	09/13/2013	SV	1309028
200.7	Potassium	< 10000	U	ug/L	2500	10	09/13/2013	SV	1309028
200.7	Selenium	< 1000	U	ug/L	600	10	09/13/2013	SV	1309028
200.7	Silver	< 100	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Sodium**	**3000**	J	ug/L	2500	10	09/13/2013	SV	1309028
200.7	**Strontium**	**1340**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Thallium	< 500	U	ug/L	200	10	09/13/2013	SV	1309028
200.7	Vanadium	< 500	U	ug/L	100	10	09/13/2013	SV	1309028
200.7	**Zinc**	**5430**		ug/L	100	10	09/13/2013	SV	1309028

Metals (Total Recov) by EPA 200/7000 Series Methods

Station ID: RBSW03_08142013 **Date / Time Sampled:** 08/14/13 15:40 **Workorder:** C130809
EPA Tag No: 8-A **Matrix:** Surface Water **Lab Number:** C130809-15 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**4420**		ug/L	200	10	09/13/2013	SV	1309028
200.7	Antimony	< 1000	U	ug/L	500	10	09/13/2013	SV	1309028
200.7	Arsenic	< 1000	U	ug/L	600	10	09/13/2013	SV	1309028
200.7	Barium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Beryllium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Cadmium**	**31.6**	J	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Calcium**	**427000**		ug/L	500	10	09/13/2013	SV	1309028
200.7	Chromium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Cobalt**	**107**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Copper**	**43.7**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Iron**	**103000**		ug/L	1000	10	09/13/2013	SV	1309028
200.7	Lead	< 250	U	ug/L	100	10	09/13/2013	SV	1309028
200.7	**Magnesium**	**26300**		ug/L	1000	10	09/13/2013	SV	1309028
200.7	**Manganese**	**34200**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Molybdenum	< 200	U	ug/L	100	10	09/13/2013	SV	1309028
200.7	**Nickel**	**70.0**	J	ug/L	50.0	10	09/13/2013	SV	1309028
200.7	Potassium	< 10000	U	ug/L	2500	10	09/13/2013	SV	1309028
200.7	**Selenium**	**754**	J	ug/L	600	10	09/13/2013	SV	1309028
200.7	Silver	< 100	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Sodium**	**8220**	J	ug/L	2500	10	09/13/2013	SV	1309028
200.7	**Strontium**	**4930**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Thallium	< 500	U	ug/L	200	10	09/13/2013	SV	1309028
200.7	Vanadium	< 500	U	ug/L	100	10	09/13/2013	SV	1309028
200.7	**Zinc**	**16200**		ug/L	100	10	09/13/2013	SV	1309028

Project Name: Red and Bonita Mine_Surface Water_AUG 2013_D382 **Certificate of Analysis**

TDF #: DG-382

Metals (Total Recov) by EPA 200/7000 Series Methods

Station ID: RBSW99_08092013 **Date / Time Sampled:** 08/09/13 18:10 **Workorder:** C130809
EPA Tag No: 8-A **Matrix:** Surface Water **Lab Number:** C130809-17 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**2220**		ug/L	200	10	09/13/2013	SV	1309028
200.7	Antimony	< 1000	U	ug/L	500	10	09/13/2013	SV	1309028
200.7	Arsenic	< 1000	U	ug/L	600	10	09/13/2013	SV	1309028
200.7	Barium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Beryllium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Cadmium**	**35.5**	J	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Calcium**	**417000**		ug/L	500	10	09/13/2013	SV	1309028
200.7	Chromium	< 50.0	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Cobalt**	**114**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Copper**	**34.6**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Iron**	**60400**		ug/L	1000	10	09/13/2013	SV	1309028
200.7	Lead	< 250	U	ug/L	100	10	09/13/2013	SV	1309028
200.7	**Magnesium**	**25900**		ug/L	1000	10	09/13/2013	SV	1309028
200.7	**Manganese**	**32200**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Molybdenum	< 200	U	ug/L	100	10	09/13/2013	SV	1309028
200.7	**Nickel**	**65.0**	J	ug/L	50.0	10	09/13/2013	SV	1309028
200.7	Potassium	< 10000	U	ug/L	2500	10	09/13/2013	SV	1309028
200.7	Selenium	< 1000	U	ug/L	600	10	09/13/2013	SV	1309028
200.7	Silver	< 100	U	ug/L	20.0	10	09/13/2013	SV	1309028
200.7	**Sodium**	**58200**		ug/L	2500	10	09/13/2013	SV	1309028
200.7	**Strontium**	**4780**		ug/L	20.0	10	09/13/2013	SV	1309028
200.7	Thallium	< 500	U	ug/L	200	10	09/13/2013	SV	1309028
200.7	Vanadium	< 500	U	ug/L	100	10	09/13/2013	SV	1309028
200.7	**Zinc**	**15200**		ug/L	100	10	09/13/2013	SV	1309028

"J" Qualifier indicates an estimated value

Mercury only (Total) by EPA 245.1 / 7470A Method

Station ID: RBMW01_08132013 **Date / Time Sampled:** 08/13/13 09:40 **Workorder:** C130809
EPA Tag No: 8-A **Matrix:** Surface Water **Lab Number:** C130809-01 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
245.1	Mercury	< 0.200	U	ug/L	0.100	1	08/23/2013	NP	1308076

Mercury only (Total) by EPA 245.1 / 7470A Method

Station ID: RBMW02_08132013 **Date / Time Sampled:** 08/13/13 10:00 **Workorder:** C130809
EPA Tag No: 8-A **Matrix:** Surface Water **Lab Number:** C130809-03 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
245.1	Mercury	< 0.200	U	ug/L	0.100	1	08/23/2013	NP	1308076

Mercury only (Total) by EPA 245.1 / 7470A Method

Station ID: RBMW03_08132013 **Date / Time Sampled:** 08/13/13 11:00 **Workorder:** C130809
EPA Tag No: 8-A **Matrix:** Surface Water **Lab Number:** C130809-05 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
245.1	Mercury	< 0.200	U	ug/L	0.100	1	08/23/2013	NP	1308076

Mercury only (Total) by EPA 245.1 / 7470A Method

Station ID: RBSW01_08072013 **Date / Time Sampled:** 08/07/13 08:15 **Workorder:** C130809
EPA Tag No: 8-A **Matrix:** Surface Water **Lab Number:** C130809-07 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
245.1	Mercury	< 0.200	U	ug/L	0.100	1	08/23/2013	NP	1308076

Mercury only (Total) by EPA 245.1 / 7470A Method

Station ID: RBSW02_08092013 **Date / Time Sampled:** 08/09/13 18:10 **Workorder:** C130809
EPA Tag No: 8-A **Matrix:** Surface Water **Lab Number:** C130809-09 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
245.1	Mercury	< 0.200	U	ug/L	0.100	1	08/23/2013	NP	1308076

Mercury only (Total) by EPA 245.1 / 7470A Method

Station ID: RBSW02_08142013 **Date / Time Sampled:** 08/14/13 12:30 **Workorder:** C130809
EPA Tag No: 8-A **Matrix:** Surface Water **Lab Number:** C130809-11 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
245.1	Mercury	< 0.200	U	ug/L	0.100	1	08/23/2013	NP	1308076

Mercury only (Total) by EPA 245.1 / 7470A Method

Station ID: RBSW03_08072013 **Date / Time Sampled:** 08/07/13 08:55 **Workorder:** C130809
EPA Tag No: 8-A **Matrix:** Surface Water **Lab Number:** C130809-13 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
245.1	Mercury	< 0.200	U	ug/L	0.100	1	08/23/2013	NP	1308076

Mercury only (Total) by EPA 245.1 / 7470A Method

Station ID: RBSW03_08142013 **Date / Time Sampled:** 08/14/13 15:40 **Workorder:** C130809
EPA Tag No: 8-A **Matrix:** Surface Water **Lab Number:** C130809-15 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
245.1	Mercury	< 0.200	U	ug/L	0.100	1	08/23/2013	NP	1308076

Project Name: Red and Bonita Mine_Surface Water_AUG 2013_D382 **Certificate of Analysis**

TDF #: DG-382

Mercury only (Total) by EPA 245.1 / 7470A Method

Station ID: RBSW99_08092013 **Date / Time Sampled:** 08/09/13 18:10 **Workorder:** C130809
EPA Tag No: 8-A **Matrix:** Surface Water **Lab Number:** C130809-17 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
245.1	Mercury	< 0.200	U	ug/L	0.100	1	08/23/2013	NP	1308076

"J" Qualifier indicates an estimated value

Metals (Dissolved) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
ICPOE - PE Optima									
Batch 1309045 - No Lab Prep Reqd			***Water***						**ICPOE - PE Optima**
Method Blank (1309045-BLK1)		Dilution Factor: 1					Prepared: 09/12/13 Analyzed: 09/13/13		
Silver	< 2.00	10.0	ug/L						
Aluminum	< 20.0	50.0	"						
Arsenic	< 60.0	100	"						
Barium	< 2.00	5.00	"						
Beryllium	< 2.00	5.00	"						
Calcium	< 50.0	100	"						
Cadmium	< 2.00	5.00	"						
Cobalt	< 2.00	5.00	"						
Chromium	< 2.00	5.00	"						
Copper	< 2.00	2.00	"						
Iron	< 100	250	"						
Potassium	< 250	1000	"						
Magnesium	< 100	250	"						
Manganese	< 2.00	5.00	"						
Molybdenum	< 10.0	20.0	"						
Sodium	< 250	1000	"						
Nickel	< 5.00	10.0	"						
Lead	< 10.0	25.0	"						
Antimony	< 50.0	100	"						
Selenium	< 60.0	100	"						
Strontium	< 2.00	10.0	"						
Thallium	< 20.0	50.0	"						
Vanadium	< 10.0	50.0	"						
Zinc	< 10.0	20.0	"						
Method Blank Spike (1309045-BS1)		Dilution Factor: 1					Prepared: 09/12/13 Analyzed: 09/13/13		
Silver	102.8	10.0	ug/L	100		103	85-115		
Aluminum	10340	50.0	"	10100		102	85-115		
Arsenic	78.51	100	"	100		79	85-115		
Barium	101.2	5.00	"	100		101	85-115		
Beryllium	103.3	5.00	"	100		103	85-115		
Calcium	10410	100	"	10100		103	85-115		
Cadmium	103.5	5.00	"	100		103	85-115		
Cobalt	101.1	5.00	"	100		101	85-115		
Chromium	98.70	5.00	"	100		99	85-115		
Copper	99.03	2.00	"	100		99	85-115		
Iron	10610	250	"	10100		105	85-115		
Potassium	10500	1000	"	10100		104	85-115		
Magnesium	10380	250	"	10100		103	85-115		
Manganese	101.6	5.00	"	100		102	85-115		

Metals (Dissolved) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1309045 - No Lab Prep Reqd			*Water*						ICPOE - PE Optima
Method Blank Spike (1309045-BS1)		Dilution Factor: 1				Prepared: 09/12/13 Analyzed: 09/13/13			
Molybdenum	97.86	20.0	ug/L	100		98	85-115		
Sodium	10400	1000	"	10100		103	85-115		
Nickel	104.1	10.0	"	100		104	85-115		
Lead	101.7	25.0	"	100		102	85-115		
Antimony	87.41	100	"	100		87	85-115		
Selenium	541.3	100	"	500		108	85-115		
Strontium	539.7	10.0	"	500		108	85-115		
Thallium	107.4	50.0	"	100		107	85-115		
Vanadium	103.2	50.0	"	100		103	85-115		
Zinc	102.1	20.0	"	100		102	85-115		
Duplicate (1309045-DUP1)		Dilution Factor: 1	**Source: C130809-02**			Prepared: 09/12/13 Analyzed: 09/13/13			
Silver	< 20.0	100	ug/L		< 20.0				20
Aluminum	11230	500	"		11150			0.7	20
Arsenic	< 600	1000	"		< 600				20
Barium	< 20.0	50.0	"		< 20.0				20
Beryllium	< 20.0	50.0	"		< 20.0				20
Calcium	478700	1000	"		477900			0.2	20
Cadmium	98.83	50.0	"		92.03			7	20
Cobalt	128.4	50.0	"		130.6			2	20
Chromium	< 20.0	50.0	"		< 20.0				20
Copper	28.33	20.0	"		30.06			6	20
Iron	44740	2500	"		44740			0.002	20
Potassium	< 2500	10000	"		< 2500				20
Magnesium	32280	2500	"		32350			0.2	20
Manganese	28360	50.0	"		28420			0.2	20
Molybdenum	101.8	200	"		< 100				20
Sodium	9260	10000	"		9385			1	20
Nickel	72.79	100	"		110.0			41	20
Lead	< 100	250	"		< 100				20
Antimony	< 500	1000	"		< 500				20
Selenium	< 600	1000	"		< 600				20
Strontium	5463	100	"		5539			1	20
Thallium	< 200	500	"		< 200				20
Vanadium	< 100	500	"		< 100				20
Zinc	17560	200	"		17400			0.9	20

Metals (Dissolved) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1309045 - No Lab Prep Reqd			*Water*						ICPOE - PE Optima
Matrix Spike (1309045-MS1)		Dilution Factor: 1		**Source: C130809-02**		Prepared: 09/12/13 Analyzed: 09/13/13			
Silver	104.9	100	ug/L	100	< 20.0	105	75-125		
Aluminum	20830	500	"	10100	11150	96	75-125		
Arsenic	< 600	1000	"	100	< 600		75-125		
Barium	90.64	50.0	"	100	< 20.0	91	75-125		
Beryllium	99.71	50.0	"	100	< 20.0	100	75-125		
Calcium	457000	1000	"	10100	477900	NR	75-125		
Cadmium	186.9	50.0	"	100	92.03	95	75-125		
Cobalt	219.7	50.0	"	100	130.6	89	75-125		
Chromium	77.14	50.0	"	100	< 20.0	77	75-125		
Copper	134.5	20.0	"	100	30.06	104	75-125		
Iron	51810	2500	"	10100	44740	70	75-125		
Potassium	12270	10000	"	10100	< 2500	122	75-125		
Magnesium	40850	2500	"	10100	32350	84	75-125		
Manganese	26820	50.0	"	100	28420	NR	75-125		
Molybdenum	143.7	200	"	100	< 100	144	75-125		
Sodium	19650	10000	"	10100	9385	102	75-125		
Nickel	201.4	100	"	100	110.0	91	75-125		
Lead	155.6	250	"	100	< 100	156	75-125		
Antimony	< 500	1000	"	100	< 500		75-125		
Selenium	1000	1000	"	500	< 600	200	75-125		
Strontium	5695	100	"	500	5539	31	75-125		
Thallium	< 200	500	"	100	< 200		75-125		
Vanadium	101.8	500	"	100	< 100	102	75-125		
Zinc	16740	200	"	100	17400	NR	75-125		
Matrix Spike Dup (1309045-MSD1)		Dilution Factor: 1		**Source: C130809-02**		Prepared: 09/12/13 Analyzed: 09/13/13			
Silver	106.1	100	ug/L	100	< 20.0	106	75-125	1	20
Aluminum	21040	500	"	10100	11150	98	75-125	1	20
Arsenic	< 600	1000	"	100	< 600		75-125		20
Barium	90.65	50.0	"	100	< 20.0	91	75-125	0.01	20
Beryllium	99.32	50.0	"	100	< 20.0	99	75-125	0.4	20
Calcium	475000	1000	"	10100	477900	NR	75-125	4	20
Cadmium	190.9	50.0	"	100	92.03	99	75-125	2	20
Cobalt	219.6	50.0	"	100	130.6	89	75-125	0.06	20
Chromium	76.77	50.0	"	100	< 20.0	77	75-125	0.5	20
Copper	133.6	20.0	"	100	30.06	104	75-125	0.6	20
Iron	53390	2500	"	10100	44740	86	75-125	3	20
Potassium	12310	10000	"	10100	< 2500	122	75-125	0.3	20
Magnesium	41580	2500	"	10100	32350	91	75-125	2	20
Manganese	27580	50.0	"	100	28420	NR	75-125	3	20
Molybdenum	147.9	200	"	100	< 100	148	75-125	3	20

Metals (Dissolved) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1309045 - No Lab Prep Reqd			*Water*						ICPOE - PE Optima
Matrix Spike Dup (1309045-MSD1)		Dilution Factor: 1	**Source: C130809-02**			Prepared: 09/12/13 Analyzed: 09/13/13			
Sodium	19720	10000	ug/L	10100	9385	102	75-125	0.3	20
Nickel	200.9	100	"	100	110.0	91	75-125	0.3	20
Lead	138.9	250	"	100	< 100	139	75-125	11	20
Antimony	< 500	1000	"	100	< 500		75-125		20
Selenium	910.3	1000	"	500	< 600	182	75-125	9	20
Strontium	5845	100	"	500	5539	61	75-125	3	20
Thallium	< 200	500	"	100	< 200		75-125		20
Vanadium	105.6	500	"	100	< 100	106	75-125	4	20
Zinc	17010	200	"	100	17400	NR	75-125	2	20
Batch 1309054 - 1309045			*Water*						ICPOE - PE Optima
Serial Dilution (1309054-SRD1)		Dilution Factor: 5	**Source: C130809-02**			Prepared: 09/12/13 Analyzed: 09/13/13			
Silver	< 100	500	ug/L		< 20.00				10
Aluminum	10500	2500	"		11150			6	10
Arsenic	< 3000	5000	"		< 600.00				10
Barium	< 100	250	"		< 20.00				10
Beryllium	< 100	250	"		< 20.00				10
Calcium	470900	5000	"		477900			1	10
Cadmium	110.2	250	"		92.03			18	10
Cobalt	111.4	250	"		130.6			16	10
Chromium	< 100	250	"		< 20.00				10
Copper	< 100	100	"		30.06				10
Iron	43090	12500	"		44740			4	10
Potassium	< 12500	50000	"		< 2,500.00				10
Magnesium	31130	12500	"		32350			4	10
Manganese	28270	250	"		28420			0.5	10
Molybdenum	< 500	1000	"		< 100.00				10
Sodium	< 12500	50000	"		9385				10
Nickel	< 250	500	"		110.0				10
Lead	< 500	1250	"		< 100.00				10
Antimony	< 2500	5000	"		< 500.00				10
Selenium	< 3000	5000	"		< 600.00				10
Strontium	5537	500	"		5539			0.04	10
Thallium	< 1000	2500	"		< 200.00				10
Vanadium	< 500	2500	"		< 100.00				10
Zinc	16940	1000	"		17400			3	10

NOTE: %R = % Recovery, %R limits do not apply when sample levels exceed 4x the spike level.
RPD = Relative Percent Difference, %D = % Difference, DL = Detection Limit for QC sample .

Metals (Total Recov) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
ICPOE - PE Optima									
Batch 1309028 - 200.2 - TR Metals			*Water*						**ICPOE - PE Optima**
Method Blank (1309028-BLK1)		Dilution Factor: 1					Prepared: 09/09/13 Analyzed: 09/13/13		
Silver	< 2.00	10.0	ug/L						
Aluminum	< 20.0	50.0	"						
Arsenic	< 60.0	100	"						
Barium	< 2.00	5.00	"						
Beryllium	< 2.00	5.00	"						
Calcium	< 50.0	100	"						
Cadmium	< 2.00	5.00	"						
Cobalt	< 2.00	5.00	"						
Chromium	< 2.00	5.00	"						
Copper	< 2.00	2.00	"						
Iron	< 100	250	"						
Potassium	< 250	1000	"						
Magnesium	< 100	250	"						
Manganese	< 2.00	5.00	"						
Molybdenum	< 10.0	20.0	"						
Sodium	< 250	1000	"						
Nickel	< 5.00	10.0	"						
Lead	< 10.0	25.0	"						
Antimony	< 50.0	100	"						
Selenium	< 60.0	100	"						
Thallium	< 20.0	50.0	"						
Vanadium	< 10.0	50.0	"						
Zinc	< 10.0	20.0	"						
Strontium	< 2.00	10.0	"						
Duplicate (1309028-DUP1)		Dilution Factor: 1	**Source: C130809-01**				Prepared: 09/09/13 Analyzed: 09/13/13		
Silver	< 20.0	100	ug/L		< 20.0				20
Aluminum	11280	500	"		11420			1	20
Arsenic	< 600	1000	"		< 600				20
Barium	< 20.0	50.0	"		< 20.0				20
Beryllium	< 20.0	50.0	"		< 20.0				20
Calcium	478600	1000	"		478100			0.1	20
Cadmium	96.49	50.0	"		91.59			5	20
Cobalt	126.0	50.0	"		126.2			0.1	20
Chromium	< 20.0	50.0	"		< 20.0				20
Copper	23.14	20.0	"		33.73			37	20
Iron	91870	2500	"		87130			5	20
Potassium	< 2500	10000	"		< 2500				20
Magnesium	32410	2500	"		32610			0.6	20
Manganese	28310	50.0	"		28420			0.4	20

Metals (Total Recov) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1309028 - 200.2 - TR Metals			*Water*						ICPOE - PE Optima
Duplicate (1309028-DUP1)		Dilution Factor: 1	**Source: C130809-01**			Prepared: 09/09/13 Analyzed: 09/13/13			
Molybdenum	< 100	200	ug/L		106.9				20
Sodium	9515	10000	"		9548			0.4	20
Nickel	97.68	100	"		88.95			9	20
Lead	< 100	250	"		< 100				20
Antimony	< 500	1000	"		< 500				20
Selenium	615.3	1000	"		< 600				20
Thallium	< 200	500	"		< 200				20
Vanadium	< 100	500	"		< 100				20
Zinc	17270	200	"		17470			1	20
Strontium	5525	100	"		5553			0.5	20
Matrix Spike (1309028-MS1)		Dilution Factor: 1	**Source: C130809-01**			Prepared: 09/09/13 Analyzed: 09/13/13			
Silver	83.53	100	ug/L	75.0	< 20.0	111	70-130		
Aluminum	13190	500	"	2000	11420	89	70-130		
Arsenic	< 600	1000	"	800	< 600		70-130		
Barium	193.7	50.0	"	200	< 20.0	97	70-130		
Beryllium	202.8	50.0	"	200	< 20.0	101	70-130		
Calcium	480200	1000	"	1000	478100	211	70-130		
Cadmium	299.2	50.0	"	200	91.59	104	70-130		
Cobalt	329.5	50.0	"	200	126.2	102	70-130		
Chromium	365.1	50.0	"	400	< 20.0	91	70-130		
Copper	353.3	20.0	"	300	33.73	107	70-130		
Iron	92980	2500	"	3000	87130	195	70-130		
Potassium	12440	10000	"	10000	< 2500	124	70-130		
Magnesium	34320	2500	"	2000	32610	85	70-130		
Manganese	28550	50.0	"	200	28420	69	70-130		
Molybdenum	452.8	200	"	400	106.9	86	70-130		
Sodium	12540	10000	"	3000	9548	100	70-130		
Nickel	597.4	100	"	500	88.95	102	70-130		
Lead	1032	250	"	1000	< 100	103	70-130		
Antimony	826.8	1000	"	800	< 500	103	70-130		
Selenium	2709	1000	"	2000	< 600	135	70-130		
Vanadium	315.8	500	"	300	< 100	105	70-130		
Zinc	17740	200	"	200	17470	133	70-130		
Strontium	5702	100	"	200	5553	75	70-130		

Metals (Total Recov) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1309028 - 200.2 - TR Metals			*Water*						ICPOE - PE Optima
Matrix Spike Dup (1309028-MSD1)		Dilution Factor: 1	**Source: C130809-01**			Prepared: 09/09/13 Analyzed: 09/13/13			
Silver	85.02	100	ug/L	75.0	< 20.0	113	70-130	2	20
Aluminum	13260	500	"	2000	11420	92	70-130	0.5	20
Arsenic	740.7	1000	"	800	< 600	93	70-130		20
Barium	195.8	50.0	"	200	< 20.0	98	70-130	1	20
Beryllium	207.1	50.0	"	200	< 20.0	104	70-130	2	20
Calcium	481100	1000	"	1000	478100	307	70-130	0.2	20
Cadmium	299.5	50.0	"	200	91.59	104	70-130	0.08	20
Cobalt	342.4	50.0	"	200	126.2	108	70-130	4	20
Chromium	370.8	50.0	"	400	< 20.0	93	70-130	2	20
Copper	356.9	20.0	"	300	33.73	108	70-130	1	20
Iron	93040	2500	"	3000	87130	197	70-130	0.06	20
Potassium	12720	10000	"	10000	< 2500	127	70-130	2	20
Magnesium	34430	2500	"	2000	32610	91	70-130	0.3	20
Manganese	28670	50.0	"	200	28420	126	70-130	0.4	20
Molybdenum	446.9	200	"	400	106.9	85	70-130	1	20
Sodium	12670	10000	"	3000	9548	104	70-130	1	20
Nickel	632.0	100	"	500	88.95	109	70-130	6	20
Lead	1142	250	"	1000	< 100	114	70-130	10	20
Antimony	734.3	1000	"	800	< 500	92	70-130	12	20
Selenium	2571	1000	"	2000	< 600	129	70-130	5	20
Vanadium	319.0	500	"	300	< 100	106	70-130	1	20
Zinc	17870	200	"	200	17470	199	70-130	0.7	20
Strontium	5723	100	"	200	5553	85	70-130	0.4	20
Post Spike (1309028-PS1)		Dilution Factor: 1	**Source: C130809-01**			Prepared: 09/09/13 Analyzed: 09/13/13			
Silver	110.6		ug/L	100	12.09	98	85-115		
Aluminum	21260		"	10100	11420	97	85-115		
Arsenic	60.38		"	100	-167.4	228	85-115		
Barium	90.27		"	100	-4.144	94	85-115		
Beryllium	104.6		"	100	1.206	103	85-115		
Calcium	475700		"	10100	478100	NR	85-115		
Cadmium	193.2		"	100	91.59	102	85-115		
Cobalt	226.6		"	100	126.2	100	85-115		
Chromium	74.23		"	100	-20.75	95	85-115		
Copper	128.2		"	100	33.73	94	85-115		
Iron	97210		"	10100	87130	100	85-115		
Potassium	12430		"	10100	2144	102	85-115		
Magnesium	41880		"	10100	32610	92	85-115		
Manganese	27530		"	100	28420	NR	85-115		
Molybdenum	160.1		"	100	106.9	53	85-115		
Sodium	20170		"	10100	9548	105	85-115		

Metals (Total Recov) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1309028 - 200.2 - TR Metals			*Water*						ICPOE - PE Optima
Post Spike (1309028-PS1)		Dilution Factor: 1	**Source: C130809-01**			Prepared: 09/09/13 Analyzed: 09/13/13			
Nickel	167.5		ug/L	100	88.95	79	85-115		
Lead	126.4		"	100	33.69	93	85-115		
Antimony	1.571		"	100	14.96	NR	85-115		
Selenium	838.1		"	500	200.7	127	85-115		
Vanadium	66.30		"	100	-6.560	73	85-115		
Zinc	16830		"	100	17470	NR	85-115		
Strontium	5894		"	500	5553	68	85-115		
Reference (1309028-SRM1)		Dilution Factor: 1				Prepared: 09/09/13 Analyzed: 09/13/13			
Silver	254.0	10.0	ug/L	250		102	85-115		
Aluminum	953.7	50.0	"	1000		95	85-115		
Arsenic	2027	100	"	2000		101	85-115		
Barium	1000	5.00	"	1000		100	85-115		
Beryllium	1006	5.00	"	1000		101	85-115		
Calcium	899.2	100	"	1000		90	85-115		
Cadmium	982.6	5.00	"	1000		98	85-115		
Cobalt	1026	5.00	"	1000		103	85-115		
Chromium	963.0	5.00	"	1000		96	85-115		
Copper	1051	2.00	"	1000		105	85-115		
Iron	917.1	250	"	1000		92	85-115		
Potassium	4967	1000	"	5000		99	85-115		
Magnesium	996.9	250	"	1000		100	85-115		
Manganese	1033	5.00	"	1000		103	85-115		
Molybdenum	1010	20.0	"	1000		101	85-115		
Sodium	1002	1000	"	1000		100	85-115		
Nickel	1041	10.0	"	1000		104	85-115		
Lead	2051	25.0	"	2000		103	85-115		
Antimony	1964	100	"	2000		98	85-115		
Selenium	1025	100	"	1000		103	85-115		
Thallium	5136	50.0	"	5000		103	85-115		
Vanadium	998.3	50.0	"	1000		100	85-115		
Zinc	1007	20.0	"	1000		101	85-115		
Strontium	1055	10.0	"	1000		105	85-115		

Metals (Total Recov) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1309055 - 1309028			*Water*						ICPOE - PE Optima
Serial Dilution (1309055-SRD1)		Dilution Factor: 5	**Source: C130809-01**		Prepared: 09/09/13 Analyzed: 09/13/13				
Silver	< 100	500	ug/L		< 20.00				10
Aluminum	10680	2500	"		11420			7	10
Arsenic	< 3000	5000	"		< 600.00				10
Barium	< 100	250	"		< 20.00				10
Beryllium	< 100	250	"		< 20.00				10
Calcium	464500	5000	"		478100			3	10
Cadmium	113.7	250	"		91.59			22	10
Cobalt	145.9	250	"		126.2			14	10
Chromium	< 100	250	"		< 20.00				10
Copper	< 100	100	"		33.73				10
Iron	91110	12500	"		87130			4	10
Potassium	< 12500	50000	"		< 2,500.00				10
Magnesium	31270	12500	"		32610			4	10
Manganese	28320	250	"		28420			0.3	10
Molybdenum	< 500	1000	"		106.9				10
Sodium	< 12500	50000	"		9548				10
Nickel	< 250	500	"		88.95				10
Lead	< 500	1250	"		< 100.00				10
Antimony	< 2500	5000	"		< 500.00				10
Selenium	< 3000	5000	"		< 600.00				10
Thallium	< 1000	2500	"		< 200.00				10
Vanadium	< 500	2500	"		< 100.00				10
Zinc	16890	1000	"		17470			3	10
Strontium	5547	500	"		5553			0.1	10

NOTE: %R = % Recovery, %R limits do not apply when sample levels exceed 4x the spike level.
RPD = Relative Percent Difference, %D = % Difference, DL = Detection Limit for QC sample .

Mercury only (Total) by EPA 245.1 / 7470A Method - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
ICPMS-PE DRC-II									
Batch 1308076 - EPA 245.1/245.2 Prep			***Water***						**ICPMS-PE DRC-II**
Method Blank (1308076-BLK1)		Dilution Factor: 1				Prepared: 08/22/13 Analyzed: 08/23/13			
Mercury	< 0.100	0.200	ug/L						
Method Blank Spike (1308076-BS1)		Dilution Factor: 1				Prepared: 08/22/13 Analyzed: 08/23/13			
Mercury	5.34	0.200	ug/L	5.00		107	85-115		
Duplicate (1308076-DUP1)		Dilution Factor: 1	**Source: C130809-01**			Prepared: 08/22/13 Analyzed: 08/23/13			
Mercury	< 0.100	0.200	ug/L		< 0.100				20
Matrix Spike (1308076-MS1)		Dilution Factor: 1	**Source: C130809-01**			Prepared: 08/22/13 Analyzed: 08/23/13			
Mercury	5.40	0.200	ug/L	5.00	< 0.100	108	75-125		
Matrix Spike Dup (1308076-MSD1)		Dilution Factor: 1	**Source: C130809-01**			Prepared: 08/22/13 Analyzed: 08/23/13			
Mercury	5.41	0.200	ug/L	5.00	< 0.100	108	75-125	0.1	20

NOTE: %R = % Recovery, %R limits do not apply when sample levels exceed 4x the spike level.
RPD = Relative Percent Difference, %D = % Difference, DL = Detection Limit for QC sample .

TechLaw Inc., ESAT Region 8

INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: 245.1 Analysis Name: TM_Mercury 245.1

Instrument: ICPMS-PE DRC-II Work Order: Nu C130809

Analytical Sequence: 1309004 **Total** Concentration Units: ug/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	Initial Calibration Blank (1 & 2)	Continuing Calibration Blanks				Method Blank (Batch ID)		PQL
		1	2	3	4	1308076-BLK1	NA	
	0.00	0.00	0.00	0.00				
Mercury		5	6	7	8	0.00	NA	0.20

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TechLaw Inc., ESAT Region 8

INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: 200.7 Analysis Name: ICPOE Diss. Metals

Instrument: ICPOE - PE Optima Work Order: Nu C130809

Analytical Sequence: 1309054 **Dissolved** Concentration Units: ug/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	Initial Calibration Blank (1 & 2)	Continuing Calibration Blanks				Method Blank (Batch ID)		PQL
		1	2	3	4	1309045-BLK1	NA	
Silver	0.00	0.09	0.07			-0.10	NA	10.00
		5	6	7	8			
		1	2	3	4	1309045-BLK1	NA	
Aluminum	-3.09	-1.53	-2.49			-3.55	NA	50.00
		5	6	7	8			
		1	2	3	4	1309045-BLK1	NA	
Arsenic	-9.48	-3.13	-2.60			-11.06	NA	100.00
		5	6	7	8			
		1	2	3	4	1309045-BLK1	NA	
Barium	-0.02	-0.05	-0.09			-0.14	NA	5.00
		5	6	7	8			
		1	2	3	4	1309045-BLK1	NA	
Beryllium	0.13	0.22	0.11			-0.37	NA	5.00
		5	6	7	8			
		1	2	3	4	1309045-BLK1	NA	
Calcium	-16.45	-18.80	-18.98			-16.30	NA	100.00
		5	6	7	8			
		1	2	3	4	1309045-BLK1	NA	
Cadmium	0.51	0.14	0.44			-0.04	NA	5.00
		5	6	7	8			
		1	2	3	4	1309045-BLK1	NA	
Cobalt	-0.08	-0.11	0.00			0.01	NA	5.00
		5	6	7	8			

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INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: 200.7 Analysis Name: ICPOE Diss. Metals

Instrument: ICPOE - PE Optima Work Order: Nu C130809

Analytical Sequence: 1309054 **Dissolved** Concentration Units: ug/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	Initial Calibration Blank (1 & 2)	Continuing Calibration Blanks				Method Blank (Batch ID)		PQL
		1	2	3	4	1309045-BLK1	NA	
Chromium	0.23	0.26	-0.04			-0.22	NA	5.00
		5	6	7	8			
		1	2	3	4	1309045-BLK1	NA	
Copper	0.16	-0.39	0.20			0.83	NA	2.00
		5	6	7	8			
		1	2	3	4	1309045-BLK1	NA	
Iron	12.80	15.96	7.51			28.72	NA	250.00
		5	6	7	8			
		1	2	3	4	1309045-BLK1	NA	
Potassium	6.47	0.59	9.93			4.72	NA	1,000.00
		5	6	7	8			
		1	2	3	4	1309045-BLK1	NA	
Magnesium	-7.92	-7.76	-7.74			-6.18	NA	250.00
		5	6	7	8			
		1	2	3	4	1309045-BLK1	NA	
Manganese	0.06	0.09	0.12			-0.21	NA	5.00
		5	6	7	8			
		1	2	3	4	1309045-BLK1	NA	
Molybdenum	3.52	3.24	1.59			2.35	NA	20.00
		5	6	7	8			
		1	2	3	4	1309045-BLK1	NA	
Sodium	-1.15	0.21	-0.63			-3.66	NA	1,000.00
		5	6	7	8			

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INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: 200.7 Analysis Name: ICPOE Diss. Metals

Instrument: ICPOE - PE Optima Work Order: Nu C130809

Analytical Sequence: 1309054 **Dissolved** Concentration Units: ug/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	Initial Calibration Blank (1 & 2)	Continuing Calibration Blanks				Method Blank (Batch ID)		PQL
		1	2	3	4	1309045-BLK1	NA	
Nickel	0.62	-1.69	-0.80			0.62	NA	10.00
		5	6	7	8			
		1	2	3	4	1309045-BLK1	NA	
Lead	1.22	-2.17	-2.92			-3.74	NA	25.00
		5	6	7	8			
		1	2	3	4	1309045-BLK1	NA	
Antimony	6.17	25.67	28.61			12.59	NA	100.00
		5	6	7	8			
		1	2	3	4	1309045-BLK1	NA	
Selenium	9.01	19.42	24.09			17.41	NA	100.00
		5	6	7	8			
		1	2	3	4	1309045-BLK1	NA	
Strontium	0.15	-0.07	-0.04			0.04	NA	10.00
		5	6	7	8			
		1	2	3	4	1309045-BLK1	NA	
Thallium	12.43	6.49	6.24			11.98	NA	50.00
		5	6	7	8			
		1	2	3	4	1309045-BLK1	NA	
Vanadium	-0.07	-3.50	-1.73			1.59	NA	50.00
		5	6	7	8			
		1	2	3	4	1309045-BLK1	NA	
Zinc	1.59	0.39	0.56			-1.83	NA	20.00
		5	6	7	8			

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INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: 200.7 Analysis Name: ICPOE Tot. Rec. Metals

Instrument: ICPOE - PE Optima Work Order: Nu C130809

Analytical Sequence: 1309055 **Total Recoverable** Concentration Units: ug/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	Initial Calibration Blank (1 & 2)	Continuing Calibration Blanks				Method Blank (Batch ID)		PQL
Silver	0.00	1	2	3	4	1309028-BLK1	NA	10.00
		0.09	0.07	0.21	0.09	0.32	NA	
		5	6	7	8			
Aluminum	-3.09	1	2	3	4	1309028-BLK1	NA	50.00
		-1.53	-2.49	-1.08	-1.42	-3.35	NA	
		5	6	7	8			
Arsenic	-9.48	1	2	3	4	1309028-BLK1	NA	100.00
		-3.13	-2.60	-2.32	9.84	-8.80	NA	
		5	6	7	8			
Barium	-0.02	1	2	3	4	1309028-BLK1	NA	5.00
		-0.05	-0.09	-0.11	-0.16	-0.16	NA	
		5	6	7	8			
Beryllium	0.13	1	2	3	4	1309028-BLK1	NA	5.00
		0.22	0.11	0.09	0.03	0.02	NA	
		5	6	7	8			
Calcium	-16.45	1	2	3	4	1309028-BLK1	NA	100.00
		-18.80	-18.98	-21.69	-21.66	-23.69	NA	
		5	6	7	8			
Cadmium	0.51	1	2	3	4	1309028-BLK1	NA	5.00
		0.14	0.44	0.75	0.44	0.47	NA	
		5	6	7	8			
Cobalt	-0.08	1	2	3	4	1309028-BLK1	NA	5.00
		-0.11	0.00	0.70	-0.02	0.37	NA	
		5	6	7	8			

Project Name: Red and Bonita Mine_Surface Water_AUG 2013_D382 **Certificate of Analysis**

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INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: 200.7 Analysis Name: ICPOE Tot. Rec. Metals

Instrument: ICPOE - PE Optima Work Order: Nu C130809

Analytical Sequence: 1309055 **Total Recoverable** Concentration Units: ug/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	Initial Calibration Blank (1 & 2)	Continuing Calibration Blanks				Method Blank (Batch ID)		PQL
		1	2	3	4	1309028-BLK1	NA	
Chromium	0.23	0.26	-0.04	0.27	0.39	-0.35	NA	5.00
		5	6	7	8			
		1	2	3	4	1309028-BLK1	NA	
Copper	0.16	-0.39	0.20	0.20	0.68	0.65	NA	2.00
		5	6	7	8			
		1	2	3	4	1309028-BLK1	NA	
Iron	12.80	15.96	7.51	2.41	-19.10	-8.60	NA	250.00
		5	6	7	8			
		1	2	3	4	1309028-BLK1	NA	
Potassium	6.47	0.59	9.93	5.93	-3.22	58.78	NA	1,000.00
		5	6	7	8			
		1	2	3	4	1309028-BLK1	NA	
Magnesium	-7.92	-7.76	-7.74	-8.28	-8.14	-10.58	NA	250.00
		5	6	7	8			
		1	2	3	4	1309028-BLK1	NA	
Manganese	0.06	0.09	0.12	0.04	0.06	-0.10	NA	5.00
		5	6	7	8			
		1	2	3	4	1309028-BLK1	NA	
Molybdenum	3.52	3.24	1.59	1.86	1.93	-0.19	NA	20.00
		5	6	7	8			
		1	2	3	4	1309028-BLK1	NA	
Sodium	-1.15	0.21	-0.63	-7.00	-6.64	15.70	NA	1,000.00
		5	6	7	8			

Project Name: Red and Bonita Mine_Surface Water_AUG 2013_D382 **Certificate of Analysis**

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INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: 200.7 Analysis Name: ICPOE Tot. Rec. Metals

Instrument: ICPOE - PE Optima Work Order: Nu C130809

Analytical Sequence: 1309055 **Total Recoverable** Concentration Units: ug/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	Initial Calibration Blank (1 & 2)	Continuing Calibration Blanks				Method Blank (Batch ID)		PQL
		1	2	3	4	1309028-BLK1	NA	
Nickel	0.62	-1.69	-0.80	-1.09	-1.59	-1.49	NA	10.00
		5	6	7	8			
		1	2	3	4	1309028-BLK1	NA	
Lead	1.22	-2.17	-2.92	-0.65	-0.35	-0.90	NA	25.00
		5	6	7	8			
		1	2	3	4	1309028-BLK1	NA	
Antimony	6.17	25.67	28.61	21.08	31.10	4.44	NA	100.00
		5	6	7	8			
		1	2	3	4	1309028-BLK1	NA	
Selenium	9.01	19.42	24.09	9.71	36.45	10.29	NA	100.00
		5	6	7	8			
		1	2	3	4	1309028-BLK1	NA	
Thallium	12.43	6.49	6.24	10.07	9.15	7.18	NA	50.00
		5	6	7	8			
		1	2	3	4	1309028-BLK1	NA	
Vanadium	-0.07	-3.50	-1.73	-2.00	-0.92	-0.65	NA	50.00
		5	6	7	8			
		1	2	3	4	1309028-BLK1	NA	
Zinc	1.59	0.39	0.56	0.78	0.04	3.67	NA	20.00
		5	6	7	8			
		1	2	3	4	1309028-BLK1	NA	
Strontium	0.15	-0.07	-0.04	-0.13	-0.12	-0.25	NA	10.00
		5	6	7	8			

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPMS-PE DRC-II Method: 245.1 Analysis Name: TM_Mercury 245.1

Sequence: 1309004 Work Order: C130809 Units: ug/L

Total Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
					1			2			3	
				5.00	5.21	104.2	5.00	4.95	99.0	5.00	4.93	98.6
	5.00	5.24	104.8		4			5			6	
Mercury												
					7			8			9	

Metals - ICV & CCV %R Criteria = 90 - 110%, Classical Chemistry %R Criteria - ICV = 90 - 110%R, CCV = 80 - 120%R.

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPOE - PE Optima Method: 200.7 Analysis Name: ICPOE Diss. Metals

Sequence: 1309054 Work Order: C130809 Units: ug/L

Dissolved Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Aluminum	12500	12660	101.3	1			2			3		
				12500	12630	101.0	12500	12710	101.7			
				4			5			6		
				7			8			9		
Antimony	2500	2471	98.8	1			2			3		
				2500	2484	99.4	2500	2476	99.0			
				4			5			6		
				7			8			9		
Arsenic	2500	2536	101.4	1			2			3		
				2500	2557	102.3	2500	2587	103.5			
				4			5			6		
				7			8			9		
Barium	500	508.6	101.7	1			2			3		
				500	497.9	99.6	500	495.3	99.1			
				4			5			6		
				7			8			9		
Beryllium	500	505.2	101.0	1			2			3		
				500	506.2	101.2	500	505.6	101.1			
				4			5			6		
				7			8			9		
Cadmium	500	509.4	101.9	1			2			3		
				500	499.6	99.9	500	495.9	99.2			
				4			5			6		
				7			8			9		

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPOE - PE Optima Method: 200.7 Analysis Name: ICPOE Diss. Metals

Sequence: 1309054 Work Order: C130809 Units: ug/L

Dissolved Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Calcium	12500	12820	102.6	1			2			3		
				12500	12460	99.7	12500	12460	99.7			
				4			5			6		
				7			8			9		
Chromium	2500	2547	101.9	1			2			3		
				2500	2451	98.0	2500	2436	97.4			
				4			5			6		
				7			8			9		
Cobalt	500	510.9	102.2	1			2			3		
				500	505.9	101.2	500	506.7	101.3			
				4			5			6		
				7			8			9		
Copper	1000	1012	101.2	1			2			3		
				1000	1027	102.7	1000	1030	103.0			
				4			5			6		
				7			8			9		
Iron	12500	13150	105.2	1			2			3		
				12500	12890	103.1	12500	12640	101.1			
				4			5			6		
				7			8			9		
Lead	2500	2563	102.5	1			2			3		
				2500	2570	102.8	2500	2567	102.7			
				4			5			6		
				7			8			9		

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPOE - PE Optima Method: 200.7 Analysis Name: ICPOE Diss. Metals

Sequence: 1309054 Work Order: C130809 Units: ug/L

Dissolved Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Magnesium	12500	12790	102.3	1			2			3		
				12500	12690	101.5	12500	12730	101.8			
				4			5			6		
				7			8			9		
Manganese	1000	1026	102.6	1			2			3		
				1000	1012	101.2	1000	1010	101.0			
				4			5			6		
				7			8			9		
Molybdenum	500	496.1	99.2	1			2			3		
				500	492.6	98.5	500	493.3	98.7			
				4			5			6		
				7			8			9		
Nickel	2500	2577	103.1	1			2			3		
				2500	2548	101.9	2500	2549	102.0			
				4			5			6		
				7			8			9		
Potassium	25000	25110	100.4	1			2			3		
				25000	25280	101.1	25000	25550	102.2			
				4			5			6		
				7			8			9		
Selenium	2500	2564	102.6	1			2			3		
				2500	2675	107.0	2500	2651	106.0			
				4			5			6		
				7			8			9		

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPOE - PE Optima Method: 200.7 Analysis Name: ICPOE Diss. Metals

Sequence: 1309054 Work Order: C130809 Units: ug/L

Dissolved Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Silver	250	256.3	102.5	1			2			3		
				250	255.3	102.1	250	255.1	102.0			
				4			5			6		
				7			8			9		
Sodium	12500	12550	100.4	1			2			3		
				12500	12920	103.4	12500	13050	104.4			
				4			5			6		
				7			8			9		
Strontium	500	512.4	102.5	1			2			3		
				500	517.5	103.5	500	517.0	103.4			
				4			5			6		
				7			8			9		
Thallium	2500	2588	103.5	1			2			3		
				2500	2625	105.0	2500	2602	104.1			
				4			5			6		
				7			8			9		
Vanadium	1000	1015	101.5	1			2			3		
				1000	1000	100.0	1000	1000	100.0			
				4			5			6		
				7			8			9		
Zinc	2500	2557	102.3	1			2			3		
				2500	2543	101.7	2500	2532	101.3			
				4			5			6		
				7			8			9		

Metals - ICV & CCV %R Criteria = 90 - 110%, Classical Chemistry %R Criteria - ICV = 90 - 110%R, CCV = 80 - 120%R.

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPOE - PE Optima Method: 200.7 Analysis Name: ICPOE Tot. Rec. Metals

Sequence: 1309055 Work Order: C130809 Units: ug/L

Total Recoverable Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Aluminum	12500	12660	101.3		1			2			3	
				12500	12630	101.0	12500	12710	101.7	12500	12730	101.8
					4			5			6	
				12500	12700	101.6						
					7			8			9	
Antimony	2500	2471	98.8		1			2			3	
				2500	2484	99.4	2500	2476	99.0	2500	2422	96.9
					4			5			6	
				2500	2487	99.5						
					7			8			9	
Arsenic	2500	2536	101.4		1			2			3	
				2500	2557	102.3	2500	2587	103.5	2500	2527	101.1
					4			5			6	
				2500	2577	103.1						
					7			8			9	
Barium	500	508.6	101.7		1			2			3	
				500	497.9	99.6	500	495.3	99.1	500	488.8	97.8
					4			5			6	
				500	492.4	98.5						
					7			8			9	
Beryllium	500	505.2	101.0		1			2			3	
				500	506.2	101.2	500	505.6	101.1	500	500.8	100.2
					4			5			6	
				500	504.0	100.8						
					7			8			9	
Cadmium	500	509.4	101.9		1			2			3	
				500	499.6	99.9	500	495.9	99.2	500	484.7	96.9
					4			5			6	
				500	490.8	98.2						
					7			8			9	

Project Name: Red and Bonita Mine_Surface Water_AUG 2013_D382 **Certificate of Analysis**

TDF #: DG-382

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPOE - PE Optima Method: 200.7 Analysis Name: ICPOE Tot. Rec. Metals

Sequence: 1309055 Work Order: C130809 Units: ug/L

Total Recoverable Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Calcium	12500	12820	102.6	1			2			3		
				12500	12460	99.7	12500	12460	99.7	12500	12320	98.6
				4			5			6		
				12500	12350	98.8						
				7			8			9		
Chromium	2500	2547	101.9	1			2			3		
				2500	2451	98.0	2500	2436	97.4	2500	2386	95.4
				4			5			6		
				2500	2415	96.6						
				7			8			9		
Cobalt	500	510.9	102.2	1			2			3		
				500	505.9	101.2	500	506.7	101.3	500	500.5	100.1
				4			5			6		
				500	503.4	100.7						
				7			8			9		
Copper	1000	1012	101.2	1			2			3		
				1000	1027	102.7	1000	1030	103.0	1000	1016	101.6
				4			5			6		
				1000	1031	103.1						
				7			8			9		
Iron	12500	13150	105.2	1			2			3		
				12500	12890	103.1	12500	12640	101.1	12500	12530	100.2
				4			5			6		
				12500	12390	99.1						
				7			8			9		
Lead	2500	2563	102.5	1			2			3		
				2500	2570	102.8	2500	2567	102.7	2500	2542	101.7
				4			5			6		
				2500	2568	102.7						
				7			8			9		

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPOE - PE Optima Method: 200.7 Analysis Name: ICPOE Tot. Rec. Metals

Sequence: 1309055 Work Order: C130809 Units: ug/L

Total Recoverable Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Magnesium	12500	12790	102.3	1			2			3		
				12500	12690	101.5	12500	12730	101.8	12500	12750	102.0
				4			5			6		
				12500	12640	101.1						
				7			8			9		
Manganese	1000	1026	102.6	1			2			3		
				1000	1012	101.2	1000	1010	101.0	1000	999.8	100.0
				4			5			6		
				1000	1006	100.6						
				7			8			9		
Molybdenum	500	496.1	99.2	1			2			3		
				500	492.6	98.5	500	493.3	98.7	500	490.1	98.0
				4			5			6		
				500	493.9	98.8						
				7			8			9		
Nickel	2500	2577	103.1	1			2			3		
				2500	2548	101.9	2500	2549	102.0	2500	2517	100.7
				4			5			6		
				2500	2542	101.7						
				7			8			9		
Potassium	25000	25110	100.4	1			2			3		
				25000	25280	101.1	25000	25550	102.2	25000	25800	103.2
				4			5			6		
				25000	25690	102.8						
				7			8			9		
Selenium	2500	2564	102.6	1			2			3		
				2500	2675	107.0	2500	2651	106.0	2500	2570	102.8
				4			5			6		
				2500	2675	107.0						
				7			8			9		

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPOE - PE Optima Method: 200.7 Analysis Name: ICPOE Tot. Rec. Metals

Sequence: 1309055 Work Order: C130809 Units: ug/L

Total Recoverable Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Silver	250	256.3	102.5		1			2			3	
				250	255.3	102.1	250	255.1	102.0	250	250.1	100.0
					4			5			6	
				250	254.5	101.8						
					7			8			9	
Sodium	12500	12550	100.4		1			2			3	
				12500	12920	103.4	12500	13050	104.4	12500	13100	104.8
					4			5			6	
				12500	12960	103.7						
					7			8			9	
Strontium	500	512.4	102.5		1			2			3	
				500	517.5	103.5	500	517.0	103.4	500	516.9	103.4
					4			5			6	
				500	518.8	103.8						
					7			8			9	
Thallium	2500	2588	103.5		1			2			3	
				2500	2625	105.0	2500	2602	104.1	2500	2588	103.5
					4			5			6	
				2500	2615	104.6						
					7			8			9	
Vanadium	1000	1015	101.5		1			2			3	
				1000	1000	100.0	1000	1000	100.0	1000	981.5	98.2
					4			5			6	
				1000	992.6	99.3						
					7			8			9	
Zinc	2500	2557	102.3		1			2			3	
				2500	2543	101.7	2500	2532	101.3	2500	2474	99.0
					4			5			6	
				2500	2519	100.8						
					7			8			9	

Metals - ICV & CCV %R Criteria = 90 - 110%, Classical Chemistry %R Criteria - ICV = 90 - 110%R, CCV = 80 - 120%R.

TechLaw, Inc. - ESAT Region 8

ICP Interference Check Sample

ICPOE - PE Optima

Analyte	Check Sample	Result*	Units	True	%R	PQL
Sequence: 1309054 Analysis: ICPOE Diss. Metals						
Aluminum	IFA1	60,032.0	ug/L	60,000	100	50.0
	IFB1	59,086.3	ug/L	60,000	98	50.0
Antimony	IFA1	51.6	ug/L			100
	IFB1	988.3	ug/L	1,000	99	100
Arsenic	IFA1	-24.5	ug/L			100
	IFB1	1,006.8	ug/L	1,000	101	100
Barium	IFA1	-2.0	ug/L			5.00
	IFB1	291.8	ug/L	300	97	5.00
Beryllium	IFA1	-1.0	ug/L			5.00
	IFB1	94.1	ug/L	100	94	5.00
Cadmium	IFA1	-5.5	ug/L			5.00
	IFB1	282.7	ug/L	300	94	5.00
Calcium	IFA1	295,073.8	ug/L	300,000	98	100
	IFB1	296,505.8	ug/L	300,000	99	100
Chromium	IFA1	-2.5	ug/L			5.00
	IFB1	289.7	ug/L	300	97	5.00
Cobalt	IFA1	4.6	ug/L			5.00
	IFB1	290.8	ug/L	300	97	5.00
Copper	IFA1	2.0	ug/L			2.00
	IFB1	308.7	ug/L	300	103	2.00
Iron	IFA1	228,938.8	ug/L	250,000	92	250
	IFB1	236,107.2	ug/L	250,000	94	250
Lead	IFA1	8.0	ug/L			25.0
	IFB1	993.5	ug/L	1,000	99	25.0
Magnesium	IFA1	141,458.2	ug/L	150,000	94	250
	IFB1	139,381.7	ug/L	150,000	93	250
Manganese	IFA1	-0.6	ug/L			5.00
	IFB1	196.2	ug/L	200	98	5.00
Molybdenum	IFA1	-7.1	ug/L			20.0
	IFB1	282.4	ug/L	300	94	20.0
Nickel	IFA1	4.1	ug/L			10.0
	IFB1	286.0	ug/L	300	95	10.0
Potassium	IFA1	-96.5	ug/L			1000
	IFB1	20,875.9	ug/L	20,000	104	1000

TechLaw, Inc. - ESAT Region 8

ICP Interference Check Sample

ICPOE - PE Optima

Analyte	Check Sample	Result*	Units	True	%R	PQL
Sequence: 1309054 Analysis: ICPOE Diss. Metals						
Selenium	IFA1	-39.0	ug/L			100
	IFB1	577.5	ug/L	500	115	100
Silver	IFA1	3.3	ug/L			10.0
	IFB1	315.3	ug/L	300	105	10.0
Sodium	IFA1	51,103.4	ug/L	50,000	102	1000
	IFB1	49,509.4	ug/L	50,000	99	1000
Strontium	IFA1	-1.4	ug/L			10.0
	IFB1	1,007.6	ug/L	1,000	101	10.0
Thallium	IFA1	19.9	ug/L			50.0
	IFB1	960.9	ug/L	1,000	96	50.0
Vanadium	IFA1	-0.8	ug/L			50.0
	IFB1	300.9	ug/L	300	100	50.0
Zinc	IFA1	0.7	ug/L			20.0
	IFB1	267.0	ug/L	300	89	20.0

*Criteria = 80-120%R of True Value or+/- PQL

See raw data for complete analyte list and results.

TechLaw, Inc. - ESAT Region 8

ICP Interference Check Sample

ICPOE - PE Optima

Analyte	Check Sample	Result*	Units	True	%R	PQL
Sequence: 1309055 Analysis: ICPOE Tot. Rec. Metals						
Aluminum	IFA1	60,032.0	ug/L	60,000	100	50.0
	IFB1	59,086.3	ug/L	60,000	98	50.0
Antimony	IFA1	51.6	ug/L			100
	IFB1	988.3	ug/L	1,000	99	100
Arsenic	IFA1	-24.5	ug/L			100
	IFB1	1,006.8	ug/L	1,000	101	100
Barium	IFA1	-2.0	ug/L			5.00
	IFB1	291.8	ug/L	300	97	5.00
Beryllium	IFA1	-1.0	ug/L			5.00
	IFB1	94.1	ug/L	100	94	5.00
Cadmium	IFA1	-5.5	ug/L			5.00
	IFB1	282.7	ug/L	300	94	5.00
Calcium	IFA1	295,073.8	ug/L	300,000	98	100
	IFB1	296,505.8	ug/L	300,000	99	100
Chromium	IFA1	-2.5	ug/L			5.00
	IFB1	289.7	ug/L	300	97	5.00
Cobalt	IFA1	4.6	ug/L			5.00
	IFB1	290.8	ug/L	300	97	5.00
Copper	IFA1	2.0	ug/L			2.00
	IFB1	308.7	ug/L	300	103	2.00
Iron	IFA1	228,938.8	ug/L	250,000	92	250
	IFB1	236,107.2	ug/L	250,000	94	250
Lead	IFA1	8.0	ug/L			25.0
	IFB1	993.5	ug/L	1,000	99	25.0
Magnesium	IFA1	141,458.2	ug/L	150,000	94	250
	IFB1	139,381.7	ug/L	150,000	93	250
Manganese	IFA1	-0.6	ug/L			5.00
	IFB1	196.2	ug/L	200	98	5.00
Molybdenum	IFA1	-7.1	ug/L			20.0
	IFB1	282.4	ug/L	300	94	20.0
Nickel	IFA1	4.1	ug/L			10.0
	IFB1	286.0	ug/L	300	95	10.0
Potassium	IFA1	-96.5	ug/L			1000
	IFB1	20,875.9	ug/L	20,000	104	1000

TechLaw, Inc. - ESAT Region 8

ICP Interference Check Sample

ICPOE - PE Optima

Analyte	Check Sample	Result*	Units	True	%R	PQL
Sequence: 1309055 Analysis: ICPOE Tot. Rec. Metals						
Selenium	IFA1	-39.0	ug/L			100
	IFB1	577.5	ug/L	500	115	100
Silver	IFA1	3.3	ug/L			10.0
	IFB1	315.3	ug/L	300	105	10.0
Sodium	IFA1	51,103.4	ug/L	50,000	102	1000
	IFB1	49,509.4	ug/L	50,000	99	1000
Strontium	IFA1	-1.4	ug/L			10.0
	IFB1	1,007.6	ug/L	1,000	101	10.0
Thallium	IFA1	19.9	ug/L			50.0
	IFB1	960.9	ug/L	1,000	96	50.0
Vanadium	IFA1	-0.8	ug/L			50.0
	IFB1	300.9	ug/L	300	100	50.0
Zinc	IFA1	0.7	ug/L			20.0
	IFB1	267.0	ug/L	300	89	20.0

*Criteria = 80-120%R of True Value or+/- PQL

See raw data for complete analyte list and results.

TechLaw, Inc. - ESAT Region 8
Detection Limit (PQL) Standard
ICPOE - PE Optima

Metals (Dissolved) by EPA 200/7000 Series Methods

Sequence: 1309054

Analyte	True	Found	%R	Units
Aluminum	100	95.98	96	ug/L
Antimony	50.0	48.89	98	ug/L
Arsenic	50.0	50.00	100	ug/L
Barium	10.0	10.61	106	ug/L
Beryllium	5.00	5.079	102	ug/L
Cadmium	10.0	11.23	112	ug/L
Calcium	250	239.3	96	ug/L
Chromium	10.0	10.09	101	ug/L
Cobalt	10.0	11.16	112	ug/L
Copper	10.0	9.451	95	ug/L
Iron	100	97.14	97	ug/L
Lead	30.0	28.92	96	ug/L
Magnesium	1000	1051	105	ug/L
Manganese	10.0	10.76	108	ug/L
Molybdenum	10.0	10.68	107	ug/L
Nickel	10.0	10.84	108	ug/L
Potassium	1000	1058	106	ug/L
Selenium	100	108.6	109	ug/L
Silver	10.0	10.36	104	ug/L
Sodium	1000	1054	105	ug/L
Strontium	10.0	10.95	109	ug/L
Thallium	50.0	54.19	108	ug/L
Vanadium	50.0	50.42	101	ug/L
Zinc	50.0	55.86	112	ug/L

Recovery Control Limits: 70-130% except Pb, Tl, Sb, & Hg at 50-150%.No limits for Al, Ca, Fe, K, Mg & Na.

TechLaw, Inc. - ESAT Region 8
Detection Limit (PQL) Standard
ICPOE - PE Optima

Metals (Total Recov) by EPA 200/7000 Series Methods

Sequence: 1309055

Analyte	True	Found	%R	Units
Aluminum	100	95.98	96	ug/L
Antimony	50.0	48.89	98	ug/L
Arsenic	50.0	50.00	100	ug/L
Barium	10.0	10.61	106	ug/L
Beryllium	5.00	5.079	102	ug/L
Cadmium	10.0	11.23	112	ug/L
Calcium	250	239.3	96	ug/L
Chromium	10.0	10.09	101	ug/L
Cobalt	10.0	11.16	112	ug/L
Copper	10.0	9.451	95	ug/L
Iron	100	97.14	97	ug/L
Lead	30.0	28.92	96	ug/L
Magnesium	1000	1051	105	ug/L
Manganese	10.0	10.76	108	ug/L
Molybdenum	10.0	10.68	107	ug/L
Nickel	10.0	10.84	108	ug/L
Potassium	1000	1058	106	ug/L
Selenium	100	108.6	109	ug/L
Silver	10.0	10.36	104	ug/L
Sodium	1000	1054	105	ug/L
Strontium	10.0	10.95	109	ug/L
Thallium	50.0	54.19	108	ug/L
Vanadium	50.0	50.42	101	ug/L
Zinc	50.0	55.86	112	ug/L

Recovery Control Limits: 70-130% except Pb, Tl, Sb, & Hg at 50-150%.No limits for Al, Ca, Fe, K, Mg & Na.

TechLaw Inc., ESAT Region 8

INSTRUMENT ANALYSIS SEQUENCE LOG

Analytical Method: 245.1 **Total** **Sequence ID#:** 1309004

Instrument ID #: ICPMS-PE DRC-II Water **LSR #:** DG-382

Analysis ID	Sample Name	Analysis Date	Analysis Time
1309004-ICV1	Initial Cal Check	08/23/13	10:35
1309004-ICB1	Initial Cal Blank	08/23/13	10:35
1308076-BS1	Blank Spike	08/23/13	10:35
1308076-BLK1	Blank	08/23/13	10:35
C130809-01	RBMW01_08132013	08/23/13	10:35
1308076-DUP1	Duplicate	08/23/13	10:35
1308076-MS1	Matrix Spike	08/23/13	10:35
1308076-MSD1	Matrix Spike Dup	08/23/13	10:35
C130809-03	RBMW02_08132013	08/23/13	10:35
C130809-05	RBMW03_08132013	08/23/13	10:35
C130809-07	RBSW01_08072013	08/23/13	10:35
C130809-09	RBSW02_08092013	08/23/13	10:35
1309004-CCV1	Calibration Check	08/23/13	10:35
1309004-CCB1	Calibration Blank	08/23/13	10:35
1309004-CCV2	Calibration Check	08/23/13	10:35
1309004-CCB2	Calibration Blank	08/23/13	10:35
C130809-11	RBSW02_08142013	08/23/13	10:35
C130809-13	RBSW03_08072013	08/23/13	10:35
C130809-15	RBSW03_08142013	08/23/13	10:35
C130809-17	RBSW99_08092013	08/23/13	10:35
1309004-CCV3	Calibration Check	08/23/13	10:35
1309004-CCB3	Calibration Blank	08/23/13	10:35

TechLaw Inc., ESAT Region 8

INSTRUMENT ANALYSIS SEQUENCE LOG

Analytical Method: 200.7 **Dissolved** **Sequence ID#:** 1309054

Instrument ID #: ICPOE - PE Optima Water **LSR #:** DG-382

Analysis ID	Sample Name	Analysis Date	Analysis Time
1309054-ICV1	Initial Cal Check	09/13/13	09:18
1309054-SCV1	Secondary Cal Check	09/13/13	09:21
1309054-ICB1	Initial Cal Blank	09/13/13	09:24
1309054-CRL1	Instrument RL Check	09/13/13	09:27
1309054-IFA1	Interference Check A	09/13/13	09:30
1309054-IFB1	Interference Check B	09/13/13	09:34
1309045-BLK1	Blank	09/13/13	09:38
1309045-BS1	Blank Spike	09/13/13	09:41
C130809-02	RBMW01_08132013	09/13/13	09:54
1309045-DUP1	Duplicate	09/13/13	09:57
1309054-SRD1	Serial Dilution	09/13/13	10:00
1309045-MS1	Matrix Spike	09/13/13	10:03
1309045-MSD1	Matrix Spike Dup	09/13/13	10:06
C130809-04	RBMW02_08132013	09/13/13	10:09
C130809-06	RBMW03_08132013	09/13/13	10:12
1309054-CCV1	Calibration Check	09/13/13	10:18
1309054-CCB1	Calibration Blank	09/13/13	10:21
C130809-08	RBSW01_08072013	09/13/13	10:25
C130809-10	RBSW02_08092013	09/13/13	10:28
C130809-12	RBSW02_08142013	09/13/13	10:31
C130809-14	RBSW03_08072013	09/13/13	10:34
C130809-16	RBSW03_08142013	09/13/13	10:37
C130809-18	RBSW99_08092013	09/13/13	10:40
1309054-CCV2	Calibration Check	09/13/13	10:46
1309054-CCB2	Calibration Blank	09/13/13	10:49

TechLaw Inc., ESAT Region 8

INSTRUMENT ANALYSIS SEQUENCE LOG

Analytical Method: 200.7 **Total Recoverable** **Sequence ID#:** 1309055

Instrument ID #: ICPOE - PE Optima Water **LSR #:** DG-382

Analysis ID	Sample Name	Analysis Date	Analysis Time
1309055-ICV1	Initial Cal Check	09/13/13	09:18
1309055-SCV1	Secondary Cal Check	09/13/13	09:21
1309055-ICB1	Initial Cal Blank	09/13/13	09:24
1309055-CRL1	Instrument RL Check	09/13/13	09:27
1309055-IFA1	Interference Check A	09/13/13	09:30
1309055-IFB1	Interference Check B	09/13/13	09:34
1309055-CCV1	Calibration Check	09/13/13	10:18
1309055-CCB1	Calibration Blank	09/13/13	10:21
1309055-CCV2	Calibration Check	09/13/13	10:46
1309055-CCB2	Calibration Blank	09/13/13	10:49
1309028-BLK1	Blank	09/13/13	10:56
1309028-SRM1	Reference	09/13/13	10:59
C130809-01	RBMW01_08132013	09/13/13	11:02
1309028-DUP1	Duplicate	09/13/13	11:05
1309055-SRD1	Serial Dilution	09/13/13	11:09
1309028-MS1	Matrix Spike	09/13/13	11:12
1309028-MSD1	Matrix Spike Dup	09/13/13	11:15
1309028-PS1	Post Spike	09/13/13	11:18
C130809-03	RBMW02_08132013	09/13/13	11:21
1309055-CCV3	Calibration Check	09/13/13	11:27
1309055-CCB3	Calibration Blank	09/13/13	11:30
C130809-05	RBMW03_08132013	09/13/13	11:33
C130809-07	RBSW01_08072013	09/13/13	11:36
C130809-09	RBSW02_08092013	09/13/13	11:40
C130809-11	RBSW02_08142013	09/13/13	11:43
C130809-13	RBSW03_08072013	09/13/13	11:46
C130809-15	RBSW03_08142013	09/13/13	11:49
C130809-17	RBSW99_08092013	09/13/13	11:52
1309055-CCV4	Calibration Check	09/13/13	11:58
1309055-CCB4	Calibration Blank	09/13/13	12:01

USEPA
DateShipped: 8/16/2013
CarrierName: Hand deliver

CHAIN OF CUSTODY RECORD
Site #: 08UP
Contact Name: Megan Adamczyk/ Russ Nelson
Contact Phone: 914-204-1044/ 720-505-7007

No: ESAT 08/16/13
Cooler #:
Lab: ESAT
Lab_City: Golden

Lab #	Sample #	Location	Analyses	Matrix	Collected	Numb Cont	Container	Preservative	MS/MSD
	RBMW01_08132013	RBMW01	Total Metals	Surface Water	8/13/2013	1	1L Poly	4 C	
	RBMW01_08132013	RBMW01	Dissolved Metals	Surface Water	8/13/2013	1	1L Poly	4 C	
	RBMW02_08132013	RBMW02	Total Metals	Surface Water	8/13/2013	1	1L Poly	4 C	
	RBMW02_08132013	RBMW02	Dissolved Metals	Surface Water	8/13/2013	1	1L Poly	4 C	
	RBMW03_08132013	RBMW03	Total Metals	Surface Water	8/13/2013	1	1L Poly	4 C	
	RBMW03_08132013	RBMW03	Dissolved Metals	Surface Water	8/13/2013	1	1L Poly	4 C	
	RBSW01_08072013	RBSW01	Total Metals	Surface Water	8/7/2013	2	1L Poly	HNO3 pH<2	
	RBSW02_08092013	RBSW02	Total Metals	Surface Water	8/9/2013	2	1L Poly	HNO3 pH<2	
	RBSW02_08142013	RBSW02	Total Metals	Surface Water	8/14/2013	1	1L Poly	4 C	
	RBSW02_08142013	RBSW02	Dissolved Metals	Surface Water	8/14/2013	1	1L Poly	4 C	
	RBSW03_08072013	RBSW03	Total Metals	Surface Water	8/7/2013	2	1L Poly	HNO3 pH<2	
	RBSW03_08142013	RBSW03	Total Metals	Surface Water	8/14/2013	1	1L Poly	4 C	
	RBSW99_08092013	RBSW02	Total Metals	Surface Water	8/9/2013	2	1L Poly	HNO3 pH<2	
	RBSW03_08142013	RBSW03	Dissolved Metals	Surface Water	8/14/2013	1	1L Poly	4 C	

Special Instructions: All samples submitted for dissolved metals have not been filtered or preserved. The total metals samples that correlate with the dissolved metals samples have not been preserved. The four samples with 2 bottles for total metals were originally meant to be sumbitted for totals and dissolved but were inadvertently preserved before filtering. If there is any way to run them for dissolved metals please try to do so.

SAMPLES TRANSFERRED FROM

CHAIN OF CUSTODY #

Items/Reason	Relinquished by	Date	Received by	Date	Time	Items/Reason	Relinquished By	Date	Received by	Date	Time
1 cooler	Megan Adamczyk	8/16/13		8/16/13							
		8/16/									

USEPA
DateShipped: 8/16/2013
CarrierName: Hand deliver

CHAIN OF CUSTODY RECORD
Site #: 08UP
Contact Name: Megan Adamczyk/ Russ Nelson
Contact Phone: 914-204-1044/ 720-505-7007

No: ESAT 08/16/13
Cooler #:
Lab: ESAT
Lab_City: Golden

Lab #	Sample #	Location	Analyses	Matrix	Collected	Numb Cont	Container	Preservative	MS/MSD
	RBMW01_08132013	RBMW01	Total Metals	Surface Water	8/13/2013	1	1L Poly	4 C	
	RBMW01_08132013	RBMW01	Dissolved Metals	Surface Water	8/13/2013	1	1L Poly	4 C	
	RBMW02_08132013	RBMW02	Total Metals	Surface Water	8/13/2013	1	1L Poly	4 C	
	RBMW02_08132013	RBMW02	Dissolved Metals	Surface Water	8/13/2013	1	1L Poly	4 C	
	RBMW03_08132013	RBMW03	Total Metals	Surface Water	8/13/2013	1	1L Poly	4 C	
	RBMW03_08132013	RBMW03	Dissolved Metals	Surface Water	8/13/2013	1	1L Poly	4 C	
	RBSW01_08072013	RBSW01	Total Metals	Surface Water	8/7/2013	2	1L Poly	HNO3 pH<2	
	RBSW02_08092013	RBSW02	Total Metals	Surface Water	8/9/2013	2	1L Poly	HNO3 pH<2	
	RBSW02_08142013	RBSW02	Total Metals	Surface Water	8/14/2013	1	1L Poly	4 C	
	RBSW02_08142013	RBSW02	Dissolved Metals	Surface Water	8/14/2013	1	1L Poly	4 C	
	RBSW03_08072013	RBSW03	Total Metals	Surface Water	8/7/2013	2	1L Poly	HNO3 pH<2	
	RBSW03_08142013	RBSW03	Total Metals	Surface Water	8/14/2013	1	1L Poly	4 C	
	RBSW99_08092013	RBSW02	Total Metals	Surface Water	8/9/2013	2	1L Poly	HNO3 pH<2	
	RBSW03_08142013	RBSW03	Dissolved Metals	Surface Water	8/14/2013	1	1L Poly	4 C	

Special Instructions: All samples submitted for dissolved metals have not been filtered or preserved. The total metals samples that correlate with the dissolved metals samples have not been preserved. The four samples with 2 bottles for total metals were originally meant to be sumbitted for totals and dissolved but were inadvertently preserved before filtering. If there is any way to run them for dissolved metals please try to do so.

SAMPLES TRANSFERRED FROM

CHAIN OF CUSTODY #

Items/Reason	Relinquished by	Date	Received by	Date	Time	Items/Reason	Relinquished By	Date	Received by	Date	Time
1 cooler	M Adamczyk	8/16/13		8/16/13							
		8/16/									

ED_000552_00029779-00150

1816959

C136809

ESAT Technical Direction Form

Contract No. EPW06033
EPA Region 8

Site ID: 08UP
TDF ID: DG-382
Date Issued: 7/23/2013
Date Updated:
Date Closed By:

Name: Red and Bonita Mine 2013 Samples

Details: The Contractor shall analyze one aqueous sample for total recoverable and dissolved metals (including hardness calculation), Hg, pH, TDS, and TSS as indicated in the Analytical Information Section. Additionally, one soil sample will be analyzed for total metals using the same analyte list reported for the water sample EXCEPT all metals may be reported from the 200.7 scan. The samples will be collected by Russ Nelson (Weston) and are expected to be delivered to the ESAT R8 laboratory on 7/23/13.

Site OSC is Steve Way

TO49/Subtask 49b: Inorganic Chemistry

Analytical Information:

MATRIX

☑ Water ☑ Soils ☐ Vegetation ☐ Biota

WET CHEM

☑ TSS ☑ TDS ☐ DOC ☐ Alk ☐ Chloride ☐ Sulfate ☐ Fluoride ☐ Nitrate ☐ Nitrite
Other pH

METALS

☑ Dissolved ☑ Total ☐ Total ☑ Hardness (Calc)

200.7: ☐ Ag ☑ Al ☐ As ☐ Ba ☐ Be ☐ B ☑ Ca ☐ Cd ☐ Co ☐ Cr ☐ Cu ☑ Fe ☑ K ☑ Mg
☐ Mn ☐ Mo ☑ Na ☐ Ni ☐ Pb ☐ Sb ☐ Se ☑ Sr ☐ Ti ☐ Tl ☐ V ☐ Zn ☐ SiO2

200.8: ☑ Ag ☐ Al ☑ As ☑ Ba ☑ Be ☑ Cd ☑ Co ☑ Cr ☑ Cu ☑ Mn ☐ Mo ☑ Ni ☑ Pb ☑ Sb
☑ Sc ☐ Th ☑ Tl ☐ U ☑ V ☑ Zn

7470/7471/747 ☑ Hg

FIBERS

☐ PLM ☐ TEM

Deliverables

ID	*Description*	*Due Date*	*Submission Date*
1	Provide final deliverable package to Task Monitor no later than 30 days after delivery of samples		

7/23/13

U.S. Environmental Protection Agency
Region 8
Technical and Management Services

Laboratory Services Program

Certificate of Analysis

Ref: 8TMS-L

MEMORANDUM

Date: 08/21/13

Subject: Analytical Results--- **Red and Bonita Mine_SW & Soils_JUL 2013_D382 / DG-382**

From: Don Goodrich; EPA Region8 Analytical Chemistry WAM

To: Steve Way
Superfund
1595 Wynkoop Street

Received Sample Set(s), [Work Order : Date Received]:
[C130709 : 07/23/2013]

Attached are the analytical results for the samples received from the Red and Bonita MineSW & Soils_JUL 2013_D382 sampling event, according to TDF DG-382. All analyses were performed within their method specified holding times unless otherwise noted in the following narrative.

These samples were prepared, analyzed, and verified by the Environmental Services Assistance Team Laboratory (ESAT) according to the requirements of the Technical Direction Form(TDF).

Note: The laboratory herewith transmits this deliverable to the program/project partner for determination of "final data usability" which may include data validation and data quality asessment per and in accordance with EPA QA/G-8, *Guidance on Environmental Data Verification and Data Validation*, November 2002, EPA/240/R-02/004. Laboratory data qualifiers are applied based on the*USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review,* October 2004, referred to as "NFGI".

Laboratory policy is to dispose of any remaining sample 60 days after data analysis packages are delivered to EPA. If you would like the laboratory to retain the samples for a period longer than 60 days, please contact Don Goodrich within the 60 day period at (303) 312-6687.

Case Narrative

C130709

Quality Assessment: Unless indicated by exception, the QA/QC associated with this sample set produced data within the TDF-specified criteria.

Holding Times: All samples were analyzed within their method-specified technical holding time(s).

1. Initial and Continuing calibration blanks (ICBs and CCBs).
   Exceptions: None.
2. Preparation (PB) / Method blanks (MB)
   Exceptions: None.
3. Interference Checks (ICSA / ICSAB) for ICP-MS and ICP-OE analyses only.
   Exceptions: None.
4. Initial and Continuing calibration verification analyses (ICVs and CCVs).
   Exceptions: None.
5. Laboratory Control Sample (LCS) or second source analysis or SRM.
   Exceptions: None.
6. Laboratory Fortified blank (LFB) / Blank spike (BS), same source as used for the matrix spikes. PBS performed with analyses/methods requiring preparation or digestion prior to analysis.
   Exceptions: In ICP-OE batch 1308078, antimony recovered low in the BS. Antimony results were qualified "J" as estimated.
7. Contract Reporting Detection Limit Standard, labeled as CRA, CRDL or CRL.
   Exceptions: None.
8. Laboratory Duplicate (DUP). "Source" identifies field sample duplicated in the laboratory. If either the "source" or the duplicate result is <5X the reporting limit, the %D limit of 20% does not apply.
   Exceptions: None.
9. Laboratory Matrix Spike (MS) and spike duplicate (MSD). "Source" defines original field sample fortified prior to analysis. Percent recovery (%R) limits do not apply when sample concentration(s) exceed the corresponding analyte spike level by a factor of 4 or greater.
   Exceptions: In ICP-OE batch 1308078, antimony recovered low in the MS and MSD. Antimony results were qualified "J" as estimated.
10. Serial Dilution sample analysis (SRD). "Source" is parent field sample diluted 1:5 in the laboratory. Performed for ICP-OE and ICP-MS metals analyses. Percent difference (%D) limits do not apply when analyte concentration(s) are below 50x the source sample's MDL (or 10x it's PQL).
    Exceptions: In ICP-OE sequence 1308083, copper recovered low in the SRD. As a result, the source sample was qualified "J" as estimated for copper.
11. Internal standards, criteria specified for ICP-MS analyses only, monitored at the instrument.
    Exceptions: None.
12. Any calibration using more than two-points produced a correlation coefficient equal to or greater than 0.995.
    Exceptions: None.

Acronyms and Definitions:

ESAT	Environmental Services Assistance Team
J	Data Estimated qualifier (also applied to all data less than PQL, greater than or equal to MDL)
MDL	Method Detection Limit
PQL	Practical Quantitation Limit, also known as reporting limit.
RPD	Relative Percent Difference (difference divided by the mean)
%D	Percent difference, serial dilution criteria unit, difference divided by the original result
%R	Percent recovery, analyzed (less sample contribution) divided by true value
<	Analyte NOT DETECTED at or above the Method Detection Limit(MDL)
mg/L	Parts per million (millligrams per liter). Solids equivalent = mg/Kg.
ug/L	Parts per billion (micrograms per liter). Solids equivalent = ug/Kg.
NR	No Recovery (matrix spike) - Often seen for calcium/magnesium when their concentration exceeds the spike level by > 4x.
NFGI	*USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, October 2004
RE	Sample Re-analysis. Usually seen on raw data and sequences for required sample dilutions due to over-range analytes.
U	Analyte not detected at or above MDL qualifier
D	Diluted value qualifier.

Method(s) Summary :

As defined in the Technical Direction Form (TDF), some or all of the methods listed below were used for the determination of the reported target analytes.

From EPA's *Methods for the Determination of Metals in Environmental Samples*, Supplement I, May 1994, dissolved, total, and/or total recoverable metals were determined by:

- Method 200.7 / 6010B using a PE Optima ICP-OE (ICP).
- Method 200.8 / 6020 using a Perkin-Elmer Elan 6000 ICP-MS.
- Method 200.2 for total recoverable metals (only) digestion.
- Method 245.1 using a Perkin-Elmer FIMS CV AA (aqueous mercury only).

From *Standard Methods for the Examination of Water and Wastewater*, 18th Edition, 1992, Method 2340B was used for the calculated hardness determination. Hardness is reported as mg (milligram) equivalent $CaCO_3$ per liter (L) determined as follows:

Calculated hardness = 2.497 * (Calcium, mg/L) + 4.118 * (Magnesium, mg/L).

From *EPA's Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846*,

- Method 3015A was used for microwave assisted total metals digestion.
- Method 7473 was used for mercury in solids.

From EPA's *Determination of Inorganic Anions by Ion Chromatography*, Revision 2.1, 1993, Method 300.0 was used to determine the anions.

From EPA's *Methods for Chemical Analysis of Water and Wastes*, March 1983:

- Method 310.1 was followed for the alkalinity determination.
- Method 160.1 was followed for gravimetric total dissolved solids (TDS) determination.
- Method 160.2 was used for gravimetric total suspended solids (TSS) determination.
- Method 415.3 was used for total organic carbon (TOC) determination using either an Apollo 9000 or Phoenix 8000 Non-Dispersive IR (NDIR) system. Also known as dissolved organic carbon (DOC) when performed on the dissolved sample fraction.

The quality control procedures listed in the TDF request were utilized by ESAT to verify accuracy of the results and to evaluate any matrix interferences.

Metals (Dissolved) by EPA 200/7000 Series Methods

Station ID: CR 110 MM 3 **Date / Time Sampled:** 07/17/13 17:45 **Workorder:** C130709
EPA Tag No: 8-C **Matrix:** Surface Water **Lab Number:** C130709-03 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**8180**		ug/L	20.0	1	08/21/2013	SV	1308078
200.7	Antimony	< 100	J,	ug/L	50.0	1	08/21/2013	SV	1308078
200.7	Arsenic	< 100	U	ug/L	60.0	1	08/21/2013	SV	1308078
200.7	**Barium**	**42.4**		ug/L	2.00	1	08/21/2013	SV	1308078
200.7	Beryllium	< 5.00	U	ug/L	2.00	1	08/21/2013	SV	1308078
200.7	Cadmium	< 5.00	U	ug/L	2.00	1	08/21/2013	SV	1308078
200.7	**Calcium**	**81600**		ug/L	50.0	1	08/21/2013	SV	1308078
200.7	Chromium	< 5.00	U	ug/L	2.00	1	08/21/2013	SV	1308078
200.7	**Cobalt**	**36.8**		ug/L	2.00	1	08/21/2013	SV	1308078
200.7	**Copper**	**94.2**		ug/L	2.00	1	08/21/2013	SV	1308078
200.7	**Iron**	**507**		ug/L	100	1	08/21/2013	SV	1308078
200.7	Lead	< 25.0	U	ug/L	10.0	1	08/21/2013	SV	1308078
200.7	**Magnesium**	**7170**		ug/L	100	1	08/21/2013	SV	1308078
200.7	**Manganese**	**1800**		ug/L	2.00	1	08/21/2013	SV	1308078
200.7	Molybdenum	< 20.0	U	ug/L	10.0	1	08/21/2013	SV	1308078
200.7	**Nickel**	**19.3**		ug/L	5.00	1	08/21/2013	SV	1308078
200.7	**Potassium**	**2310**		ug/L	250	1	08/21/2013	SV	1308078
200.7	Selenium	< 100	U	ug/L	60.0	1	08/21/2013	SV	1308078
200.7	Silver	< 10.0	U	ug/L	2.00	1	08/21/2013	SV	1308078
200.7	**Sodium**	**2760**		ug/L	250	1	08/21/2013	SV	1308078
200.7	**Strontium**	**951**		ug/L	2.00	1	08/21/2013	SV	1308078
200.7	Thallium	< 50.0	U	ug/L	20.0	1	08/21/2013	SV	1308078
200.7	Vanadium	< 50.0	U	ug/L	10.0	1	08/21/2013	SV	1308078
200.7	**Zinc**	**206**		ug/L	10.0	1	08/21/2013	SV	1308078
2340B	**Hardness**	**233**		mg/L	2	1	08/21/2013	SV	1308078

"J" Qualifier indicates an estimated value

Metals (Total Recov) by EPA 200/7000 Series Methods

Station ID: CR 110 MM 3 **Date / Time Sampled:** 07/17/13 17:45 **Workorder:** C130709
EPA Tag No: 8-A **Matrix:** Surface Water **Lab Number:** C130709-01 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
200.7	**Aluminum**	**68100**		ug/L	100	5	08/21/2013	SV	1308068
200.7	Antimony	< 500	U	ug/L	250	5	08/21/2013	SV	1308068
200.7	Arsenic	< 500	U	ug/L	300	5	08/21/2013	SV	1308068
200.7	**Barium**	**3060**		ug/L	10.0	5	08/21/2013	SV	1308068
200.7	Beryllium	< 25.0	U	ug/L	10.0	5	08/21/2013	SV	1308068
200.7	Cadmium	< 25.0	U	ug/L	10.0	5	08/21/2013	SV	1308068
200.7	**Calcium**	**80400**		ug/L	250	5	08/21/2013	SV	1308068
200.7	**Chromium**	**11.1**	J	ug/L	10.0	5	08/21/2013	SV	1308068
200.7	**Cobalt**	**65.1**		ug/L	10.0	5	08/21/2013	SV	1308068
200.7	**Copper**	**285**	J	ug/L	10.0	5	08/21/2013	SV	1308068
200.7	**Iron**	**264000**		ug/L	500	5	08/21/2013	SV	1308068
200.7	**Lead**	**370**		ug/L	50.0	5	08/21/2013	SV	1308068
200.7	**Magnesium**	**16300**		ug/L	500	5	08/21/2013	SV	1308068
200.7	**Manganese**	**3320**		ug/L	10.0	5	08/21/2013	SV	1308068
200.7	Molybdenum	< 100	U	ug/L	50.0	5	08/21/2013	SV	1308068
200.7	**Nickel**	**36.3**	J	ug/L	25.0	5	08/21/2013	SV	1308068
200.7	**Potassium**	**21500**		ug/L	1250	5	08/21/2013	SV	1308068
200.7	Selenium	< 500	U	ug/L	300	5	08/21/2013	SV	1308068
200.7	**Silver**	**12.1**	J	ug/L	10.0	5	08/21/2013	SV	1308068
200.7	**Sodium**	**4170**	J	ug/L	1250	5	08/21/2013	SV	1308068
200.7	**Strontium**	**1560**		ug/L	10.0	5	08/21/2013	SV	1308068
200.7	Thallium	< 250	U	ug/L	100	5	08/21/2013	SV	1308068
200.7	**Vanadium**	**124**	J	ug/L	50.0	5	08/21/2013	SV	1308068
200.7	**Zinc**	**400**		ug/L	50.0	5	08/21/2013	SV	1308068

Metals (Total Recov) by EPA 200/7000 Series Methods

Station ID: Settling Pond CR 110 **Date / Time Sampled:** 07/19/13 16:30 **Workorder:** C130709
EPA Tag No: 8-A **Matrix:** Soil **Lab Number:** C130709-04 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
EPA 200.2/200.7	**Aluminum**	**3280**		mg/kg dry wt	19.9	10	08/21/2013	SV	1308069
EPA 200.2/200.7	Antimony	< 99.7	U	mg/kg dry wt	49.8	10	08/21/2013	SV	1308069
EPA 200.2/200.7	**Arsenic**	**67.1**	J	mg/kg dry wt	59.8	10	08/21/2013	SV	1308069
EPA 200.2/200.7	**Barium**	**12.2**		mg/kg dry wt	0.997	10	08/21/2013	SV	1308069
EPA 200.2/200.7	Beryllium	< 4.98	U	mg/kg dry wt	1.99	10	08/21/2013	SV	1308069
EPA 200.2/200.7	**Cadmium**	**3.21**	J	mg/kg dry wt	1.99	10	08/21/2013	SV	1308069
EPA 200.2/200.7	**Calcium**	**2630**		mg/kg dry wt	99.7	10	08/21/2013	SV	1308069
EPA 200.2/200.7	Chromium	< 4.98	U	mg/kg dry wt	1.99	10	08/21/2013	SV	1308069
EPA 200.2/200.7	Cobalt	< 4.98	U	mg/kg dry wt	1.99	10	08/21/2013	SV	1308069
EPA 200.2/200.7	**Copper**	**282**		mg/kg dry wt	1.99	10	08/21/2013	SV	1308069
EPA 200.2/200.7	**Iron**	**110000**		mg/kg dry wt	99.7	10	08/21/2013	SV	1308069
EPA 200.2/200.7	**Lead**	**787**		mg/kg dry wt	9.97	10	08/21/2013	SV	1308069
EPA 200.2/200.7	**Magnesium**	**339**		mg/kg dry wt	99.7	10	08/21/2013	SV	1308069
EPA 200.2/200.7	**Manganese**	**195**		mg/kg dry wt	1.99	10	08/21/2013	SV	1308069
EPA 200.2/200.7	Molybdenum	< 19.9	U	mg/kg dry wt	9.97	10	08/21/2013	SV	1308069
EPA 200.2/200.7	Nickel	< 9.97	U	mg/kg dry wt	4.98	10	08/21/2013	SV	1308069
EPA 200.2/200.7	**Potassium**	**411**	J	mg/kg dry wt	249	10	08/21/2013	SV	1308069
EPA 200.2/200.7	Selenium	< 99.7	U	mg/kg dry wt	59.8	10	08/21/2013	SV	1308069
EPA 200.2/200.7	**Silver**	**11.0**		mg/kg dry wt	1.99	10	08/21/2013	SV	1308069
EPA 200.2/200.7	Sodium	< 997	U	mg/kg dry wt	249	10	08/21/2013	SV	1308069
EPA 200.2/200.7	**Strontium**	**28.6**		mg/kg dry wt	1.99	10	08/21/2013	SV	1308069
EPA 200.2/200.7	Thallium	< 49.8	U	mg/kg dry wt	19.9	10	08/21/2013	SV	1308069
EPA 200.2/200.7	**Vanadium**	**16.4**	J	mg/kg dry wt	9.97	10	08/21/2013	SV	1308069
EPA 200.2/200.7	**Zinc**	**1520**		mg/kg dry wt	9.97	10	08/21/2013	SV	1308069

"J" Qualifier indicates an estimated value

Classical Chemistry by EPA/ASTM/APHA Methods

Station ID: CR 110 MM 3 **Date / Time Sampled:** 07/17/13 17:45 **Workorder:** C130709
EPA Tag No: 8-B **Matrix:** Surface Water **Lab Number:** C130709-02 A

Method	Parameter	Results	Qualifier	Units	MDL	Dilution Factor	Analyzed	By	Batch
150.1	**pH**	**3.61**		pH Units		1	07/24/2013	KJB	1307084
EPA 160.1	**Total Dissolved Solids**	**454**		mg/L	10	1	07/24/2013	KJB	1307082
EPA 160.2	**Total Suspended Solids**	**5350**		mg/L	10	1	07/24/2013	KJB	1307083

"J" Qualifier indicates an estimated value

Metals (Dissolved) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
ICPOE - PE Optima									
Batch 1308078 - No Lab Prep Reqd			***Water***						**ICPOE - PE Optima**
Method Blank (1308078-BLK1)		Dilution Factor: 1					Prepared: 08/20/13 Analyzed: 08/21/13		
Silver	< 2.00	10.0	ug/L						
Aluminum	< 20.0	50.0	"						
Arsenic	< 60.0	100	"						
Barium	< 2.00	5.00	"						
Beryllium	< 2.00	5.00	"						
Calcium	< 50.0	100	"						
Cadmium	< 2.00	5.00	"						
Cobalt	< 2.00	5.00	"						
Chromium	< 2.00	5.00	"						
Copper	< 2.00	2.00	"						
Iron	< 100	250	"						
Potassium	< 250	1000	"						
Magnesium	< 100	250	"						
Manganese	< 2.00	5.00	"						
Molybdenum	< 10.0	20.0	"						
Sodium	< 250	1000	"						
Nickel	< 5.00	10.0	"						
Lead	< 10.0	25.0	"						
Antimony	< 50.0	100	"						
Selenium	< 60.0	100	"						
Strontium	< 2.00	10.0	"						
Thallium	< 20.0	50.0	"						
Vanadium	< 10.0	50.0	"						
Zinc	< 10.0	20.0	"						
Method Blank Spike (1308078-BS1)		Dilution Factor: 1					Prepared: 08/20/13 Analyzed: 08/21/13		
Silver	101.2	10.0	ug/L	100		101	85-115		
Aluminum	10350	50.0	"	10100		102	85-115		
Arsenic	92.53	100	"	100		93	85-115		
Barium	98.50	5.00	"	100		99	85-115		
Beryllium	101.0	5.00	"	100		101	85-115		
Calcium	10280	100	"	10100		102	85-115		
Cadmium	102.0	5.00	"	100		102	85-115		
Cobalt	100.2	5.00	"	100		100	85-115		
Chromium	97.57	5.00	"	100		98	85-115		
Copper	95.24	2.00	"	100		95	85-115		
Iron	10100	250	"	10100		100	85-115		
Potassium	10580	1000	"	10100		105	85-115		
Magnesium	10320	250	"	10100		102	85-115		
Manganese	99.65	5.00	"	100		100	85-115		

Metals (Dissolved) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1308078 - No Lab Prep Reqd			*Water*						ICPOE - PE Optima
Method Blank Spike (1308078-BS1)		Dilution Factor: 1				Prepared: 08/20/13 Analyzed: 08/21/13			
Molybdenum	99.39	20.0	ug/L	100		99	85-115		
Sodium	10420	1000	"	10100		103	85-115		
Nickel	99.72	10.0	"	100		100	85-115		
Lead	91.26	25.0	"	100		91	85-115		
Antimony	70.88	100	"	100		71	85-115		
Selenium	534.2	100	"	500		107	85-115		
Strontium	530.5	10.0	"	500		106	85-115		
Thallium	102.7	50.0	"	100		103	85-115		
Vanadium	97.62	50.0	"	100		98	85-115		
Zinc	100.1	20.0	"	100		100	85-115		
Duplicate (1308078-DUP1)		Dilution Factor: 1	**Source: C130709-03**			Prepared: 08/20/13 Analyzed: 08/21/13			
Silver	< 2.00	10.0	ug/L		< 2.00				20
Aluminum	8277	50.0	"		8183			1	20
Arsenic	< 60.0	100	"		< 60.0				20
Barium	42.97	5.00	"		42.44			1	20
Beryllium	< 2.00	5.00	"		< 2.00				20
Calcium	82700	100	"		81640			1	20
Cadmium	< 2.00	5.00	"		< 2.00				20
Cobalt	37.18	5.00	"		36.83			0.9	20
Chromium	< 2.00	5.00	"		< 2.00				20
Copper	95.48	2.00	"		94.23			1	20
Iron	500.7	250	"		507.0			1	20
Potassium	2329	1000	"		2314			0.6	20
Magnesium	7202	250	"		7168			0.5	20
Manganese	1817	5.00	"		1799			1	20
Molybdenum	< 10.0	20.0	"		< 10.0				20
Sodium	2767	1000	"		2764			0.1	20
Nickel	19.29	10.0	"		19.33			0.2	20
Lead	< 10.0	25.0	"		< 10.0				20
Antimony	< 50.0	100	"		< 50.0				20
Selenium	< 60.0	100	"		< 60.0				20
Strontium	953.2	10.0	"		950.9			0.2	20
Thallium	< 20.0	50.0	"		< 20.0				20
Vanadium	< 10.0	50.0	"		< 10.0				20
Zinc	210.2	20.0	"		206.1			2	20

Metals (Dissolved) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1308078 - No Lab Prep Reqd			*Water*						ICPOE - PE Optima
Matrix Spike (1308078-MS1)		Dilution Factor: 1		**Source: C130709-03**		Prepared: 08/20/13 Analyzed: 08/21/13			
Silver	102.0	10.0	ug/L	100	< 2.00	102	75-125		
Aluminum	19070	50.0	"	10100	8183	108	75-125		
Arsenic	81.60	100	"	100	< 60.0	82	75-125		
Barium	142.9	5.00	"	100	42.44	100	75-125		
Beryllium	105.3	5.00	"	100	< 2.00	105	75-125		
Calcium	92000	100	"	10100	81640	103	75-125		
Cadmium	104.3	5.00	"	100	< 2.00	104	75-125		
Cobalt	135.2	5.00	"	100	36.83	98	75-125		
Chromium	98.06	5.00	"	100	< 2.00	98	75-125		
Copper	188.3	2.00	"	100	94.23	94	75-125		
Iron	11410	250	"	10100	507.0	108	75-125		
Potassium	13770	1000	"	10100	2314	113	75-125		
Magnesium	18070	250	"	10100	7168	108	75-125		
Manganese	1840	5.00	"	100	1799	42	75-125		
Molybdenum	97.90	20.0	"	100	< 10.0	98	75-125		
Sodium	14040	1000	"	10100	2764	112	75-125		
Nickel	117.7	10.0	"	100	19.33	98	75-125		
Lead	79.64	25.0	"	100	< 10.0	80	75-125		
Antimony	67.82	100	"	100	< 50.0	68	75-125		
Selenium	563.3	100	"	500	< 60.0	113	75-125		
Strontium	< 2.00	10.0	"	500	950.9	NR	75-125		
Thallium	96.68	50.0	"	100	< 20.0	97	75-125		
Vanadium	98.51	50.0	"	100	< 10.0	99	75-125		
Zinc	303.9	20.0	"	100	206.1	98	75-125		
Matrix Spike Dup (1308078-MSD1)		Dilution Factor: 1		**Source: C130709-03**		Prepared: 08/20/13 Analyzed: 08/21/13			
Silver	99.86	10.0	ug/L	100	< 2.00	100	75-125	2	20
Aluminum	18560	50.0	"	10100	8183	103	75-125	3	20
Arsenic	80.01	100	"	100	< 60.0	80	75-125	2	20
Barium	141.7	5.00	"	100	42.44	99	75-125	0.8	20
Beryllium	103.3	5.00	"	100	< 2.00	103	75-125	2	20
Calcium	90050	100	"	10100	81640	83	75-125	2	20
Cadmium	101.8	5.00	"	100	< 2.00	102	75-125	2	20
Cobalt	133.2	5.00	"	100	36.83	96	75-125	1	20
Chromium	95.46	5.00	"	100	< 2.00	95	75-125	3	20
Copper	186.2	2.00	"	100	94.23	92	75-125	1	20
Iron	10770	250	"	10100	507.0	102	75-125	6	20
Potassium	13350	1000	"	10100	2314	109	75-125	3	20
Magnesium	17590	250	"	10100	7168	103	75-125	3	20
Manganese	1843	5.00	"	100	1799	44	75-125	0.1	20
Molybdenum	102.0	20.0	"	100	< 10.0	102	75-125	4	20

Metals (Dissolved) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1308078 - No Lab Prep Reqd			*Water*						ICPOE - PE Optima
Matrix Spike Dup (1308078-MSD1)		Dilution Factor: 1	**Source: C130709-03**			Prepared: 08/20/13 Analyzed: 08/21/13			
Sodium	13630	1000	ug/L	10100	2764	108	75-125	3	20
Nickel	115.1	10.0	"	100	19.33	96	75-125	2	20
Lead	80.57	25.0	"	100	< 10.0	81	75-125	1	20
Antimony	66.35	100	"	100	< 50.0	66	75-125	2	20
Selenium	543.6	100	"	500	< 60.0	109	75-125	4	20
Strontium	< 2.00	10.0	"	500	950.9	NR	75-125		20
Thallium	91.14	50.0	"	100	< 20.0	91	75-125	6	20
Vanadium	95.65	50.0	"	100	< 10.0	96	75-125	3	20
Zinc	301.4	20.0	"	100	206.1	95	75-125	0.8	20
Batch 1308082 - 1308078			*Water*						ICPOE - PE Optima
Serial Dilution (1308082-SRD1)		Dilution Factor: 5	**Source: C130709-03**			Prepared: 08/20/13 Analyzed: 08/21/13			
Silver	< 10.0	50.0	ug/L		< 2.00				10
Aluminum	8018	250	"		8183			2	10
Arsenic	< 300	500	"		< 60.00				10
Barium	42.60	25.0	"		42.44			0.4	10
Beryllium	< 10.0	25.0	"		< 2.00				10
Calcium	81260	500	"		81640			0.5	10
Cadmium	< 10.0	25.0	"		< 2.00				10
Cobalt	35.31	25.0	"		36.83			4	10
Chromium	< 10.0	25.0	"		< 2.00				10
Copper	90.14	10.0	"		94.23			4	10
Iron	< 500	1250	"		507.0				10
Potassium	2236	5000	"		2314			3	10
Magnesium	7041	1250	"		7168			2	10
Manganese	1796	25.0	"		1799			0.2	10
Molybdenum	< 50.0	100	"		< 10.00				10
Sodium	2744	5000	"		2764			0.7	10
Nickel	< 25.0	50.0	"		19.33				10
Lead	< 50.0	125	"		< 10.00				10
Antimony	< 250	500	"		< 50.00				10
Selenium	< 300	500	"		< 60.00				10
Strontium	964.7	50.0	"		950.9			1	10
Thallium	< 100	250	"		< 20.00				10
Vanadium	< 50.0	250	"		< 10.00				10
Zinc	197.4	100	"		206.1			4	10

NOTE: %R = % Recovery, %R limits do not apply when sample levels exceed 4x the spike level.
RPD = Relative Percent Difference, %D = % Difference, DL = Detection Limit for QC sample .

Metals (Total Recov) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
ICPOE - PE Optima									
Batch 1308068 - 200.2 - TR Metals			*Water*						**ICPOE - PE Optima**
Method Blank (1308068-BLK1)		Dilution Factor: 1					Prepared: 08/19/13 Analyzed: 08/21/13		
Silver	< 2.00	10.0	ug/L						
Aluminum	< 20.0	50.0	"						
Arsenic	< 60.0	100	"						
Barium	< 2.00	5.00	"						
Beryllium	< 2.00	5.00	"						
Calcium	< 50.0	100	"						
Cadmium	< 2.00	5.00	"						
Cobalt	< 2.00	5.00	"						
Chromium	< 2.00	5.00	"						
Copper	< 2.00	2.00	"						
Iron	< 100	250	"						
Potassium	< 250	1000	"						
Magnesium	< 100	250	"						
Manganese	< 2.00	5.00	"						
Molybdenum	< 10.0	20.0	"						
Sodium	< 250	1000	"						
Nickel	< 5.00	10.0	"						
Lead	< 10.0	25.0	"						
Antimony	< 50.0	100	"						
Selenium	< 60.0	100	"						
Thallium	< 20.0	50.0	"						
Vanadium	< 10.0	50.0	"						
Zinc	< 10.0	20.0	"						
Strontium	< 2.00	10.0	"						
Duplicate (1308068-DUP1)		Dilution Factor: 5	**Source: C130709-01**				Prepared: 08/19/13 Analyzed: 08/21/13		
Silver	14.13	50.0	ug/L		12.14			15	20
Aluminum	65860	250	"		68080			3	20
Arsenic	< 300	500	"		< 300				20
Barium	3139	25.0	"		3056			3	20
Beryllium	< 10.0	25.0	"		< 10.0				20
Calcium	84200	500	"		80440			5	20
Cadmium	< 10.0	25.0	"		< 10.0				20
Cobalt	65.22	25.0	"		65.06			0.2	20
Chromium	11.86	25.0	"		11.12			6	20
Copper	286.1	10.0	"		285.3			0.3	20
Iron	275400	1250	"		264500			4	20
Potassium	20070	5000	"		21460			7	20
Magnesium	16720	1250	"		16300			3	20
Manganese	3421	25.0	"		3316			3	20

Metals (Total Recov) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1308068 - 200.2 - TR Metals			*Water*						ICPOE - PE Optima
Duplicate (1308068-DUP1)		Dilution Factor: 5	**Source: C130709-01**			Prepared: 08/19/13 Analyzed: 08/21/13			
Molybdenum	< 50.0	100	ug/L		< 50.0				20
Sodium	4311	5000	"		4166			3	20
Nickel	25.40	50.0	"		36.28			35	20
Lead	366.9	125	"		370.4			0.9	20
Antimony	< 250	500	"		< 250				20
Selenium	< 300	500	"		< 300				20
Thallium	< 100	250	"		< 100				20
Vanadium	108.5	250	"		123.7			13	20
Zinc	403.8	100	"		399.9			1	20
Strontium	1613	50.0	"		1563			3	20
Matrix Spike (1308068-MS1)		Dilution Factor: 5	**Source: C130709-01**			Prepared: 08/19/13 Analyzed: 08/21/13			
Silver	88.59	50.0	ug/L	75.0	12.14	102	70-130		
Aluminum	75520	250	"	2000	68080	372	70-130		
Arsenic	1019	500	"	800	< 300	127	70-130		
Barium	3439	25.0	"	200	3056	191	70-130		
Beryllium	205.8	25.0	"	200	< 10.0	103	70-130		
Calcium	86280	500	"	1000	80440	584	70-130		
Cadmium	204.4	25.0	"	200	< 10.0	102	70-130		
Cobalt	277.1	25.0	"	200	65.06	106	70-130		
Chromium	408.8	25.0	"	400	11.12	99	70-130		
Copper	607.1	10.0	"	300	285.3	107	70-130		
Iron	280900	1250	"	3000	264500	546	70-130		
Potassium	29780	5000	"	10000	21460	83	70-130		
Magnesium	19030	1250	"	2000	16300	136	70-130		
Manganese	3684	25.0	"	200	3316	184	70-130		
Molybdenum	345.4	100	"	400	< 50.0	86	70-130		
Sodium	7225	5000	"	3000	4166	102	70-130		
Nickel	555.2	50.0	"	500	36.28	104	70-130		
Lead	1407	125	"	1000	370.4	104	70-130		
Antimony	< 250	500	"	800	< 250		70-130		
Selenium	1941	500	"	2000	< 300	97	70-130		
Vanadium	428.6	250	"	300	123.7	102	70-130		
Zinc	623.4	100	"	200	399.9	112	70-130		
Strontium	1913	50.0	"	200	1563	175	70-130		

Metals (Total Recov) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1308068 - 200.2 - TR Metals			*Water*						ICPOE - PE Optima
Matrix Spike Dup (1308068-MSD1)		Dilution Factor: 5	**Source: C130709-01**			Prepared: 08/19/13 Analyzed: 08/21/13			
Silver	87.57	50.0	ug/L	75.0	12.14	101	70-130	1	20
Aluminum	76460	250	"	2000	68080	419	70-130	1	20
Arsenic	1067	500	"	800	< 300	133	70-130	5	20
Barium	3517	25.0	"	200	3056	230	70-130	2	20
Beryllium	206.0	25.0	"	200	< 10.0	103	70-130	0.07	20
Calcium	87530	500	"	1000	80440	709	70-130	1	20
Cadmium	200.0	25.0	"	200	< 10.0	100	70-130	2	20
Cobalt	273.5	25.0	"	200	65.06	104	70-130	1	20
Chromium	408.0	25.0	"	400	11.12	99	70-130	0.2	20
Copper	609.0	10.0	"	300	285.3	108	70-130	0.3	20
Iron	285300	1250	"	3000	264500	694	70-130	2	20
Potassium	30280	5000	"	10000	21460	88	70-130	2	20
Magnesium	19340	1250	"	2000	16300	152	70-130	2	20
Manganese	3742	25.0	"	200	3316	213	70-130	2	20
Molybdenum	346.6	100	"	400	< 50.0	87	70-130	0.3	20
Sodium	7287	5000	"	3000	4166	104	70-130	0.9	20
Nickel	543.9	50.0	"	500	36.28	102	70-130	2	20
Lead	1415	125	"	1000	370.4	104	70-130	0.5	20
Antimony	< 250	500	"	800	< 250		70-130		20
Selenium	1860	500	"	2000	< 300	93	70-130	4	20
Vanadium	428.1	250	"	300	123.7	101	70-130	0.1	20
Zinc	622.2	100	"	200	399.9	111	70-130	0.2	20
Strontium	1929	50.0	"	200	1563	183	70-130	0.9	20
Post Spike (1308068-PS1)		Dilution Factor: 5	**Source: C130709-01**			Prepared: 08/19/13 Analyzed: 08/21/13			
Silver	114.2		ug/L	100	12.14	102	85-115		
Aluminum	75590		"	10100	68080	74	85-115		
Arsenic	316.3		"	100	153.1	163	85-115		
Barium	3258		"	100	3056	202	85-115		
Beryllium	103.1		"	100	2.294	101	85-115		
Calcium	94000		"	10100	80440	134	85-115		
Cadmium	93.40		"	100	-7.712	101	85-115		
Cobalt	167.7		"	100	65.06	103	85-115		
Chromium	108.1		"	100	11.12	97	85-115		
Copper	396.3		"	100	285.3	111	85-115		
Iron	277800		"	10100	264500	132	85-115		
Potassium	30430		"	10100	21460	89	85-115		
Magnesium	26790		"	10100	16300	104	85-115		
Manganese	3570		"	100	3316	254	85-115		
Molybdenum	94.77		"	100	-2.264	97	85-115		
Sodium	14660		"	10100	4166	104	85-115		

Metals (Total Recov) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1308068 - 200.2 - TR Metals			*Water*						ICPOE - PE Optima
Post Spike (1308068-PS1)		Dilution Factor: 5	**Source: C130709-01**			Prepared: 08/19/13 Analyzed: 08/21/13			
Nickel	130.6		ug/L	100	36.28	94	85-115		
Lead	471.2		"	100	370.4	101	85-115		
Antimony	106.1		"	100	31.83	74	85-115		
Selenium	511.3		"	500	-52.73	113	85-115		
Vanadium	221.4		"	100	123.7	98	85-115		
Zinc	518.0		"	100	399.9	118	85-115		
Strontium	2137		"	500	1563	115	85-115		
Reference (1308068-SRM1)		Dilution Factor: 1				Prepared: 08/19/13 Analyzed: 08/21/13			
Silver	258.8	10.0	ug/L	250		104	85-115		
Aluminum	972.3	50.0	"	1000		97	85-115		
Arsenic	1978	100	"	2000		99	85-115		
Barium	1020	5.00	"	1000		102	85-115		
Beryllium	995.3	5.00	"	1000		100	85-115		
Calcium	941.3	100	"	1000		94	85-115		
Cadmium	1012	5.00	"	1000		101	85-115		
Cobalt	1034	5.00	"	1000		103	85-115		
Chromium	1001	5.00	"	1000		100	85-115		
Copper	1013	2.00	"	1000		101	85-115		
Iron	922.0	250	"	1000		92	85-115		
Potassium	4948	1000	"	5000		99	85-115		
Magnesium	1003	250	"	1000		100	85-115		
Manganese	1045	5.00	"	1000		104	85-115		
Molybdenum	1011	20.0	"	1000		101	85-115		
Sodium	980.6	1000	"	1000		98	85-115		
Nickel	1040	10.0	"	1000		104	85-115		
Lead	2004	25.0	"	2000		100	85-115		
Antimony	1921	100	"	2000		96	85-115		
Selenium	990.9	100	"	1000		99	85-115		
Thallium	5049	50.0	"	5000		101	85-115		
Vanadium	1003	50.0	"	1000		100	85-115		
Zinc	1015	20.0	"	1000		102	85-115		
Strontium	1025	10.0	"	1000		103	85-115		

Metals (Total Recov) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1308069 - 200.2 - TR Metals			*Soil*						ICPOE - PE Optima
Method Blank (1308069-BLK1)		Dilution Factor: 1					Prepared: 08/19/13 Analyzed: 08/21/13		
Silver	< 2.00	10.0	mg/kg dry wt						
Aluminum	< 20.0	50.0	"						
Arsenic	< 60.0	100	"						
Barium	< 1.00	5.00	"						
Beryllium	< 2.00	5.00	"						
Calcium	< 100	250	"						
Cadmium	< 2.00	5.00	"						
Cobalt	< 2.00	5.00	"						
Chromium	< 2.00	5.00	"						
Copper	< 2.00	2.00	"						
Iron	< 100	250	"						
Potassium	< 250	1000	"						
Magnesium	< 100	250	"						
Manganese	< 2.00	5.00	"						
Molybdenum	< 10.0	20.0	"						
Sodium	< 250	1000	"						
Nickel	< 5.00	10.0	"						
Lead	< 10.0	25.0	"						
Antimony	< 50.0	100	"						
Selenium	< 60.0	100	"						
Thallium	< 20.0	50.0	"						
Vanadium	< 10.0	50.0	"						
Zinc	< 10.0	20.0	"						
Strontium	< 2.00	10.0	"						
Duplicate (1308069-DUP1)		Dilution Factor: 1	**Source: C130709-04**				Prepared: 08/19/13 Analyzed: 08/21/13		
Silver	11.702	10.0	mg/kg dry wt		11.006			6	35
Aluminum	3432.7	50.1	"		3283.2			4	35
Arsenic	< 60.1	100	"		67.066				35
Barium	12.584	5.01	"		12.196			3	35
Beryllium	< 2.00	5.01	"		< 2.00				35
Calcium	2535.0	250	"		2631.9			4	35
Cadmium	< 2.00	5.01	"		3.2080				35
Cobalt	< 2.00	5.01	"		< 2.00				35
Chromium	< 2.00	5.01	"		< 2.00				35
Copper	297.21	2.00	"		282.13			5	35
Iron	112560	250	"		109630			3	35
Potassium	383.55	1000	"		410.73			7	35
Magnesium	343.47	250	"		339.22			1	35
Manganese	188.68	5.01	"		194.70			3	35
Molybdenum	< 10.0	20.0	"		< 10.0				35

Metals (Total Recov) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1308069 - 200.2 - TR Metals			*Soil*						ICPOE - PE Optima
Duplicate (1308069-DUP1)		Dilution Factor: 1	**Source: C130709-04**			Prepared: 08/19/13 Analyzed: 08/21/13			
Sodium	< 250	1000	mg/kg dry wt		< 250				35
Nickel	< 5.01	10.0	"		< 5.01				35
Lead	804.76	25.0	"		786.52			2	35
Antimony	< 50.1	100	"		< 50.1				35
Selenium	< 60.1	100	"		< 60.1				35
Thallium	< 20.0	50.1	"		< 20.0				35
Vanadium	18.088	50.1	"		16.437			10	35
Zinc	1191.5	20.0	"		1519.7			24	35
Strontium	27.898	10.0	"		28.588			2	35
Matrix Spike (1308069-MS1)		Dilution Factor: 1	**Source: C130709-04**			Prepared: 08/19/13 Analyzed: 08/21/13			
Silver	19.394	9.97	mg/kg dry wt	7.48	11.006	112	70-130		
Aluminum	4078.6	49.9	"	199	3283.2	399	70-130		
Arsenic	140.87	99.7	"	79.8	67.066	92	70-130		
Barium	32.300	4.99	"	19.9	12.196	101	70-130		
Beryllium	19.478	4.99	"	19.9	< 1.99	98	70-130		
Calcium	2251.2	249	"	99.7	2631.9	NR	70-130		
Cadmium	23.002	4.99	"	19.9	3.2080	99	70-130		
Cobalt	22.305	4.99	"	19.9	< 1.99	112	70-130		
Chromium	40.511	4.99	"	39.9	< 1.99	102	70-130		
Copper	367.35	1.99	"	29.9	282.13	285	70-130		
Iron	119470	249	"	299	109630	NR	70-130		
Potassium	1413.3	997	"	997	410.73	101	70-130		
Magnesium	591.70	249	"	199	339.22	127	70-130		
Manganese	201.09	4.99	"	19.9	194.70	32	70-130		
Molybdenum	24.734	19.9	"	39.9	< 9.97	62	70-130		
Sodium	340.17	997	"	299	< 249	114	70-130		
Nickel	45.486	9.97	"	49.9	< 4.99	91	70-130		
Lead	903.83	24.9	"	99.7	786.52	118	70-130		
Antimony	77.863	99.7	"	79.8	< 49.9	98	70-130		
Selenium	176.63	99.7	"	199	< 59.8	89	70-130		
Thallium	197.88	49.9	"	199	< 19.9	99	70-130		
Vanadium	52.160	49.9	"	29.9	16.437	119	70-130		
Zinc	1510.3	19.9	"	19.9	1519.7	NR	70-130		
Strontium	43.424	9.97	"	19.9	28.588	74	70-130		

Metals (Total Recov) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1308069 - 200.2 - TR Metals			*Soil*						ICPOE - PE Optima
Matrix Spike Dup (1308069-MSD1)		Dilution Factor: 1	**Source: C130709-04**			Prepared: 08/19/13 Analyzed: 08/21/13			
Silver	18.476	10.1	mg/kg dry wt	7.54	11.006	99	70-130	5	35
Aluminum	3945.7	50.3	"	201	3283.2	329	70-130	3	35
Arsenic	131.82	101	"	80.5	67.066	80	70-130	7	35
Barium	33.100	5.03	"	20.1	12.196	104	70-130	2	35
Beryllium	19.446	5.03	"	20.1	< 2.01	97	70-130	0.2	35
Calcium	2270.3	251	"	101	2631.9	NR	70-130	0.8	35
Cadmium	22.299	5.03	"	20.1	3.2080	95	70-130	3	35
Cobalt	22.022	5.03	"	20.1	< 2.01	109	70-130	1	35
Chromium	40.731	5.03	"	40.2	< 2.01	101	70-130	0.5	35
Copper	336.12	2.01	"	30.2	282.13	179	70-130	9	35
Iron	106530	251	"	302	109630	NR	70-130	11	35
Potassium	1463.2	1010	"	1010	410.73	105	70-130	3	35
Magnesium	597.24	251	"	201	339.22	128	70-130	0.9	35
Manganese	190.29	5.03	"	20.1	194.70	NR	70-130	6	35
Molybdenum	27.184	20.1	"	40.2	< 10.1	68	70-130	9	35
Sodium	338.60	1010	"	302	< 251	112	70-130	0.5	35
Nickel	46.438	10.1	"	50.3	< 5.03	92	70-130	2	35
Lead	913.23	25.1	"	101	786.52	126	70-130	1	35
Antimony	71.289	101	"	80.5	< 50.3	89	70-130	9	35
Selenium	171.42	101	"	201	< 60.4	85	70-130	3	35
Thallium	198.23	50.3	"	201	< 20.1	99	70-130	0.2	35
Vanadium	46.870	50.3	"	30.2	16.437	101	70-130	11	35
Zinc	1282.2	20.1	"	20.1	1519.7	NR	70-130	16	35
Strontium	44.278	10.1	"	20.1	28.588	78	70-130	2	35
Post Spike (1308069-PS1)		Dilution Factor: 1	**Source: C130709-04**			Prepared: 08/19/13 Analyzed: 08/21/13			
Silver	213.90		ug/L	100	110.44	103	85-115		
Aluminum	43120		"	10100	32944	101	85-115		
Arsenic	602.19		"	100	672.94	NR	85-115		
Barium	221.88		"	100	122.38	100	85-115		
Beryllium	96.543		"	100	-0.12058	97	85-115		
Calcium	36562		"	10100	26409	101	85-115		
Cadmium	130.03		"	100	32.189	98	85-115		
Cobalt	118.78		"	100	17.315	101	85-115		
Chromium	102.88		"	100	6.7722	96	85-115		
Copper	2922.1		"	100	2830.9	91	85-115		
Iron	1100200		"	10100	1100100	0.9	85-115		
Potassium	14432		"	10100	4121.3	102	85-115		
Magnesium	13741		"	10100	3403.7	102	85-115		
Manganese	2027.9		"	100	1953.6	74	85-115		
Molybdenum	9.3600		"	100	-77.114	86	85-115		

Metals (Total Recov) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1308069 - 200.2 - TR Metals			*Soil*						ICPOE - PE Optima
Post Spike (1308069-PS1)		Dilution Factor: 1	**Source: C130709-04**			Prepared: 08/19/13 Analyzed: 08/21/13			
Sodium	11233		ug/L	10100	553.37	106	85-115		
Nickel	63.187		"	100	-42.738	106	85-115		
Lead	7844.3		"	100	7891.9	NR	85-115		
Antimony	256.15		"	100	180.17	76	85-115		
Selenium	384.89		"	500	-242.76	126	85-115		
Thallium	86.613		"	100	30.784	56	85-115		
Vanadium	291.96		"	100	164.93	127	85-115		
Zinc	15247		"	100	15249	NR	85-115		
Strontium	815.06		"	500	286.86	106	85-115		
Reference (1308069-SRM1)		Dilution Factor: 1				Prepared: 08/19/13 Analyzed: 08/21/13			
Silver	23.649	19.8	mg/kg dry wt	20.9		113	64-136		
Aluminum	298.29	99.0	"	309		97	63-137		
Arsenic	983.08	198	"	930		106	65-134		
Barium	2.8438	9.90	"	5.30		54	48-152		
Beryllium	19.067	9.90	"	18.8		101	82-118		
Calcium	178980	495	"	184000		97	78-122		
Cadmium	42.507	9.90	"	41.6		102	77-123		
Cobalt	149.87	9.90	"	140		107	80-120		
Chromium	103.58	9.90	"	96.5		107	80-120		
Copper	6356.6	3.96	"	6680		95	80-120		
Iron	21452	495	"	21000		102	80-120		
Potassium	< 495	1980	"	102			0-370		
Magnesium	106570	495	"	113000		94	80-120		
Manganese	213.21	9.90	"	201		106	80-120		
Sodium	< 495	1980	"	92.8			0-299		
Nickel	67.167	19.8	"	56.8		118	76.5-123.4		
Lead	204.19	49.5	"	224		91	75-125		
Antimony	285.35	198	"	213		134	61-139		
Selenium	< 119	198	"	37.0			48-152		
Thallium	< 39.6	99.0	"	38.1			64.5-135		
Vanadium	65.277	99.0	"	65.8		99	80-120		
Zinc	174.21	39.6	"	175		100	73-127		

Metals (Total Recov) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1308081 - 1308069			*Soil*						ICPOE - PE Optima
Serial Dilution (1308081-SRD1)		Dilution Factor: 5		**Source: C130709-04**			Prepared: 08/19/13 Analyzed: 08/21/13		
Silver	12.219	49.8	mg/kg dry wt		11.006			10	10
Aluminum	3376.2	249	"		3283.2			3	10
Arsenic	< 299	498	"		67.066				10
Barium	13.069	24.9	"		12.196			7	10
Beryllium	< 9.97	24.9	"		< 1.99				10
Calcium	2661.7	1250	"		2631.9			1	10
Cadmium	< 9.97	24.9	"		3.2080				10
Cobalt	< 9.97	24.9	"		< 1.99				10
Chromium	< 9.97	24.9	"		< 1.99				10
Copper	287.30	9.97	"		282.13			2	10
Iron	110330	1250	"		109630			0.6	10
Potassium	< 1250	4980	"		410.73				10
Magnesium	< 498	1250	"		339.22				10
Manganese	199.02	24.9	"		194.70			2	10
Molybdenum	< 49.8	99.7	"		< 9.96				10
Sodium	< 1250	4980	"		< 250.00				10
Nickel	< 24.9	49.8	"		< 4.98				10
Lead	803.97	125	"		786.52			2	10
Antimony	< 249	498	"		< 49.80				10
Selenium	< 299	498	"		< 59.80				10
Thallium	< 99.7	249	"		< 19.94				10
Vanadium	< 49.8	249	"		16.437				10
Zinc	1565.0	99.7	"		1519.7			3	10
Strontium	29.199	49.8	"		28.588			2	10
Batch 1308083 - 1308068			*Water*						ICPOE - PE Optima
Serial Dilution (1308083-SRD1)		Dilution Factor: 2		**Source: C130709-01**			Prepared: 08/19/13 Analyzed: 08/21/13		
Silver	< 50.0	250	ug/L		12.14				10
Aluminum	64180	1250	"		68080			6	10
Arsenic	< 1500	2500	"		< 300.00				10
Barium	2849	125	"		3056			7	10
Beryllium	< 50.0	125	"		< 10.00				10
Calcium	75820	2500	"		80440			6	10
Cadmium	< 50.0	125	"		< 10.00				10
Cobalt	63.66	125	"		65.06			2	10
Chromium	< 50.0	125	"		11.12				10
Copper	242.8	50.0	"		285.3			16	10
Iron	247500	6250	"		264500			7	10
Potassium	19790	25000	"		21460			8	10
Magnesium	15300	6250	"		16300			6	10

Metals (Total Recov) by EPA 200/7000 Series Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
Batch 1308083 - 1308068			*Water*						ICPOE - PE Optima
Serial Dilution (1308083-SRD1)		Dilution Factor: 2	**Source: C130709-01**			Prepared: 08/19/13 Analyzed: 08/21/13			
Manganese	3095	125	ug/L		3316			7	10
Molybdenum	< 250	500	"		< 50.00				10
Sodium	< 6250	25000	"		4166				10
Nickel	< 125	250	"		36.28				10
Lead	270.6	625	"		370.4			31	10
Antimony	< 1250	2500	"		< 250.00				10
Selenium	< 1500	2500	"		< 300.00				10
Thallium	< 500	1250	"		< 100.00				10
Vanadium	< 250	1250	"		123.7				10
Zinc	534.1	500	"		399.9			29	10
Strontium	1484	250	"		1563			5	10

NOTE: %R = % Recovery, %R limits do not apply when sample levels exceed 4x the spike level.
RPD = Relative Percent Difference, %D = % Difference, DL = Detection Limit for QC sample .

Classical Chemistry by EPA/ASTM/APHA Methods - Quality Control

TechLaw, Inc. - ESAT Region 8

Analyte	Result	Det. Limit	Units	Spike Level	Source Result	%R	%R Limits	%D or RPD	%D or RPD Limit
ESAT Dionex IC									
Batch 1307083 - No Prep Req			***Water***						**ESAT Dionex IC**
Method Blank (1307083-BLK1)		Dilution Factor: 1				Prepared & Analyzed: 07/24/13			
Total Suspended Solids	< 10	10	mg/L						
Duplicate (1307083-DUP1)		Dilution Factor: 1	**Source: C130709-02**			Prepared & Analyzed: 07/24/13			
Total Suspended Solids	5480	10	mg/L		5350			3	20
Reference (1307083-SRM1)		Dilution Factor: 1				Prepared & Analyzed: 07/24/13			
Total Suspended Solids	168	10	mg/L	144		117	75-125		
Mettler AT									
Batch 1307082 - No Prep Req			***Water***						**Mettler AT**
Method Blank (1307082-BLK1)		Dilution Factor: 1				Prepared & Analyzed: 07/24/13			
Total Dissolved Solids	< 10	10	mg/L						
Duplicate (1307082-DUP1)		Dilution Factor: 1	**Source: C130709-02**			Prepared & Analyzed: 07/24/13			
Total Dissolved Solids	470	10	mg/L		454			3	20
Reference (1307082-SRM1)		Dilution Factor: 1				Prepared & Analyzed: 07/24/13			
Total Dissolved Solids	4870	10	mg/L	4820		101	75-125		

NOTE: %R = % Recovery, %R limits do not apply when sample levels exceed 4x the spike level.
RPD = Relative Percent Difference, %D = % Difference, DL = Detection Limit for QC sample .

Project Name: Red and Bonita Mine_SW & Soils_JUL 2013_D382 **Certificate of Analysis**

TDF #: DG-382

TechLaw Inc, ESAT Region 8

INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: EPA 200.2/200.7 Analysis Name: ICPOE Tot. Rec. Metals

Instrument: **ICPOE - PE Optima** Work Order: Nu C130709

Analytical Sequence: 1308081 **Total Recoverable** Concentration Units: mg/kg dry wt

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	Initial Calibration Blank (1 & 2)	Continuing Calibration Blanks				Method Blank (Batch ID)		PQL
Silver	0.38	1	2	3	4	1308069-BLK1	NA	1.00
		0.49				0.61	NA	
		5	6	7	8			
Aluminum	-2.77	1	2	3	4	1308069-BLK1	NA	5.00
		-0.54				5.18	NA	
		5	6	7	8			
Arsenic	-4.17	1	2	3	4	1308069-BLK1	NA	10.00
		5.20				-1.90	NA	
		5	6	7	8			
Barium	0.10	1	2	3	4	1308069-BLK1	NA	0.50
		-0.04				0.24	NA	
		5	6	7	8			
Beryllium	0.12	1	2	3	4	1308069-BLK1	NA	0.50
		0.04				0.02	NA	
		5	6	7	8			
Calcium	-0.14	1	2	3	4	1308069-BLK1	NA	25.00
		-1.03				11.66	NA	
		5	6	7	8			
Cadmium	0.15	1	2	3	4	1308069-BLK1	NA	0.50
		0.00				0.06	NA	
		5	6	7	8			
Cobalt	0.37	1	2	3	4	1308069-BLK1	NA	0.50
		0.40				0.22	NA	
		5	6	7	8			

Project Name: Red and Bonita Mine_SW & Soils_JUL 2013_D382 **Certificate of Analysis**

TDF #: DG-382

TechLaw Inc., ESAT Region 8

INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: EPA 200.2/200.7 Analysis Name: ICPOE Tot. Rec. Metals

Instrument: **ICPOE - PE Optima** Work Order: Nu C130709

Analytical Sequence: 1308081 **Total Recoverable** Concentration Units: mg/kg dry wt

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	Initial Calibration Blank (1 & 2)	Continuing Calibration Blanks				Method Blank (Batch ID)		PQL
Chromium	0.09	1	2	3	4	1308069-BLK1	NA	0.50
		0.17				0.07	NA	
		5	6	7	8			
Copper	0.12	1	2	3	4	1308069-BLK1	NA	0.20
		-0.74				-0.17	NA	
		5	6	7	8			
Iron	6.33	1	2	3	4	1308069-BLK1	NA	25.00
		2.02				31.59	NA	
		5	6	7	8			
Potassium	6.93	1	2	3	4	1308069-BLK1	NA	100.00
		8.10				100.35	NA	
		5	6	7	8			
Magnesium	-0.56	1	2	3	4	1308069-BLK1	NA	25.00
		-0.57				4.60	NA	
		5	6	7	8			
Manganese	0.11	1	2	3	4	1308069-BLK1	NA	0.50
		0.07				0.00	NA	
		5	6	7	8			
Molybdenum	9.80	1	2	3	4	1308069-BLK1	NA	2.00
		5.27				3.23	NA	
		5	6	7	8			
Sodium	-1.24	1	2	3	4	1308069-BLK1	NA	100.00
		-5.68				36.40	NA	
		5	6	7	8			

Project Name: Red and Bonita Mine_SW & Soils_JUL 2013_D382 **Certificate of Analysis**

TDF #: DG-382

TechLaw Inc., ESAT Region 8

INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: EPA 200.2/200.7 Analysis Name: ICPOE Tot. Rec. Metals

Instrument: **ICPOE - PE Optima** Work Order: Nu C130709

Analytical Sequence: 1308081 **Total Recoverable** Concentration Units: mg/kg dry wt

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	Initial Calibration Blank (1 & 2)	Continuing Calibration Blanks				Method Blank (Batch ID)		PQL
Nickel	0.34	1	2	3	4	1308069-BLK1	NA	1.00
		0.30				0.92	NA	
		5	6	7	8			
Lead	-4.27	1	2	3	4	1308069-BLK1	NA	2.50
		-4.71				-2.69	NA	
		5	6	7	8			
Antimony	9.24	1	2	3	4	1308069-BLK1	NA	10.00
		38.90				12.06	NA	
		5	6	7	8			
Selenium	-5.26	1	2	3	4	1308069-BLK1	NA	10.00
		13.23				0.11	NA	
		5	6	7	8			
Thallium	2.83	1	2	3	4	1308069-BLK1	NA	5.00
		1.93				-2.02	NA	
		5	6	7	8			
Vanadium	-0.13	1	2	3	4	1308069-BLK1	NA	5.00
		-2.10				-0.98	NA	
		5	6	7	8			
Zinc	-0.92	1	2	3	4	1308069-BLK1	NA	2.00
		-0.18				0.51	NA	
		5	6	7	8			
Strontium	0.09	1	2	3	4	1308069-BLK1	NA	1.00
		-0.04				0.00	NA	
		5	6	7	8			

Project Name: Red and Bonita Mine_SW & Soils_JUL 2013_D382 **Certificate of Analysis**

TDF #: DG-382

TechLaw Inc., ESAT Region 8

INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: 200.7 Analysis Name: ICPOE Diss. Metals

Instrument: ICPOE - PE Optima Work Order: Nu C130709

Analytical Sequence: 1308082 **Dissolved** Concentration Units: ug/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	Initial Calibration Blank (1 & 2)	Continuing Calibration Blanks				Method Blank (Batch ID)		PQL
		1	2	3	4	1308078-BLK1	NA	
Silver	0.38	0.49	0.34			0.00	NA	10.00
		5	6	7	8			
		1	2	3	4	1308078-BLK1	NA	
Aluminum	-2.77	-0.54	-1.12			0.00	NA	50.00
		5	6	7	8			
		1	2	3	4	1308078-BLK1	NA	
Arsenic	-4.17	5.20	2.91			0.00	NA	100.00
		5	6	7	8			
		1	2	3	4	1308078-BLK1	NA	
Barium	0.10	-0.04	0.02			0.00	NA	5.00
		5	6	7	8			
		1	2	3	4	1308078-BLK1	NA	
Beryllium	0.12	0.04	0.10			0.00	NA	5.00
		5	6	7	8			
		1	2	3	4	1308078-BLK1	NA	
Calcium	-0.14	-1.03	-0.92			0.00	NA	100.00
		5	6	7	8			
		1	2	3	4	1308078-BLK1	NA	
Cadmium	0.15	0.00	0.04			0.00	NA	5.00
		5	6	7	8			
		1	2	3	4	1308078-BLK1	NA	
Cobalt	0.37	0.40	0.29			0.00	NA	5.00
		5	6	7	8			

Project Name: Red and Bonita Mine_SW & Soils_JUL 2013_D382 **Certificate of Analysis**

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INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: 200.7 Analysis Name: ICPOE Diss. Metals

Instrument: ICPOE - PE Optima Work Order: Nu C130709

Analytical Sequence: 1308082 **Dissolved** Concentration Units: ug/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	Initial Calibration Blank (1 & 2)	Continuing Calibration Blanks				Method Blank (Batch ID)		PQL
		1	2	3	4	1308078-BLK1	NA	
Chromium	0.09	0.17	0.46			0.00	NA	5.00
		5	6	7	8			
		1	2	3	4	1308078-BLK1	NA	
Copper	0.12	-0.74	-0.77			0.00	NA	2.00
		5	6	7	8			
		1	2	3	4	1308078-BLK1	NA	
Iron	6.33	2.02	-17.32			0.00	NA	250.00
		5	6	7	8			
		1	2	3	4	1308078-BLK1	NA	
Potassium	6.93	8.10	1.14			0.00	NA	1,000.00
		5	6	7	8			
		1	2	3	4	1308078-BLK1	NA	
Magnesium	-0.56	-0.57	-0.22			0.00	NA	250.00
		5	6	7	8			
		1	2	3	4	1308078-BLK1	NA	
Manganese	0.11	0.07	0.12			0.00	NA	5.00
		5	6	7	8			
		1	2	3	4	1308078-BLK1	NA	
Molybdenum	9.80	5.27	5.44			0.00	NA	20.00
		5	6	7	8			
		1	2	3	4	1308078-BLK1	NA	
Sodium	-1.24	-5.68	4.79			0.00	NA	1,000.00
		5	6	7	8			

Project Name: Red and Bonita Mine_SW & Soils_JUL 2013_D382 **Certificate of Analysis**

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INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: 200.7 Analysis Name: ICPOE Diss. Metals

Instrument: ICPOE - PE Optima Work Order: Nu C130709

Analytical Sequence: 1308082 **Dissolved** Concentration Units: ug/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	Initial Calibration Blank (1 & 2)	Continuing Calibration Blanks				Method Blank (Batch ID)		PQL
		1	2	3	4	1308078-BLK1	NA	
Nickel	0.34	0.30	0.29			0.00	NA	10.00
		5	6	7	8			
		1	2	3	4	1308078-BLK1	NA	
Lead	-4.27	-4.71	-7.17			0.00	NA	25.00
		5	6	7	8			
		1	2	3	4	1308078-BLK1	NA	
Antimony	9.24	38.90	37.98			0.00	NA	100.00
		5	6	7	8			
		1	2	3	4	1308078-BLK1	NA	
Selenium	-5.26	13.23	-5.66			0.00	NA	100.00
		5	6	7	8			
		1	2	3	4	1308078-BLK1	NA	
Strontium	0.09	-0.04	-0.04			0.00	NA	10.00
		5	6	7	8			
		1	2	3	4	1308078-BLK1	NA	
Thallium	2.83	1.93	7.70			0.00	NA	50.00
		5	6	7	8			
		1	2	3	4	1308078-BLK1	NA	
Vanadium	-0.13	-2.10	-2.04			0.00	NA	50.00
		5	6	7	8			
		1	2	3	4	1308078-BLK1	NA	
Zinc	-0.92	-0.18	-1.29			0.00	NA	20.00
		5	6	7	8			

Project Name: Red and Bonita Mine_SW & Soils_JUL 2013_D382 **Certificate of Analysis**

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TechLaw Inc, ESAT Region 8

INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: 200.7 Analysis Name: ICPOE Tot. Rec. Metals

Instrument: ICPOE - PE Optima Work Order: Nu C130709

Analytical Sequence: 1308083 **Total Recoverable** Concentration Units: ug/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	Initial Calibration Blank (1 & 2)	Continuing Calibration Blanks				Method Blank (Batch ID)		PQL
		1	2	3	4	1308068-BLK1	NA	
Silver	0.38	0.49	0.34	0.33	0.42	0.89	NA	10.00
		5	6	7	8			
		1	2	3	4	1308068-BLK1	NA	
Aluminum	-2.77	-0.54	-1.12	4.96	5.94	-3.75	NA	50.00
		5	6	7	8			
		1	2	3	4	1308068-BLK1	NA	
Arsenic	-4.17	5.20	2.91	7.21	2.54	3.32	NA	100.00
		5	6	7	8			
		1	2	3	4	1308068-BLK1	NA	
Barium	0.10	-0.04	0.02	0.08	0.05	-0.08	NA	5.00
		5	6	7	8			
		1	2	3	4	1308068-BLK1	NA	
Beryllium	0.12	0.04	0.10	0.15	0.10	0.09	NA	5.00
		5	6	7	8			
		1	2	3	4	1308068-BLK1	NA	
Calcium	-0.14	-1.03	-0.92	1.70	-0.23	1.42	NA	100.00
		5	6	7	8			
		1	2	3	4	1308068-BLK1	NA	
Cadmium	0.15	0.00	0.04	-0.14	-0.06	0.17	NA	5.00
		5	6	7	8			
		1	2	3	4	1308068-BLK1	NA	
Cobalt	0.37	0.40	0.29	0.01	0.14	-0.27	NA	5.00
		5	6	7	8			

Project Name: Red and Bonita Mine_SW & Soils_JUL 2013_D382 **Certificate of Analysis**

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INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: 200.7 Analysis Name: ICPOE Tot. Rec. Metals

Instrument: ICPOE - PE Optima Work Order: Nu C130709

Analytical Sequence: 1308083 **Total Recoverable** Concentration Units: ug/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	Initial Calibration Blank (1 & 2)	Continuing Calibration Blanks				Method Blank (Batch ID)		PQL
		1	2	3	4	1308068-BLK1	NA	
Chromium	0.09	0.17	0.46	0.47	0.43	0.10	NA	5.00
		5	6	7	8			
		1	2	3	4	1308068-BLK1	NA	
Copper	0.12	-0.74	-0.77	-0.62	-0.82	-0.80	NA	2.00
		5	6	7	8			
		1	2	3	4	1308068-BLK1	NA	
Iron	6.33	2.02	-17.32	-4.04	-1.02	-27.24	NA	250.00
		5	6	7	8			
		1	2	3	4	1308068-BLK1	NA	
Potassium	6.93	8.10	1.14	8.37	-9.57	65.99	NA	1,000.00
		5	6	7	8			
		1	2	3	4	1308068-BLK1	NA	
Magnesium	-0.56	-0.57	-0.22	0.53	1.02	-2.62	NA	250.00
		5	6	7	8			
		1	2	3	4	1308068-BLK1	NA	
Manganese	0.11	0.07	0.12	0.19	0.14	0.03	NA	5.00
		5	6	7	8			
		1	2	3	4	1308068-BLK1	NA	
Molybdenum	9.80	5.27	5.44	4.56	5.32	-0.09	NA	20.00
		5	6	7	8			
		1	2	3	4	1308068-BLK1	NA	
Sodium	-1.24	-5.68	4.79	-9.08	-8.53	38.52	NA	1,000.00
		5	6	7	8			

Project Name: Red and Bonita Mine_SW & Soils_JUL 2013_D382 **Certificate of Analysis**

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TechLaw Inc, ESAT Region 8

INORGANIC ANALYSES DATA SHEET

Intial and Continuing Calibration Blanks

Analytical Method: 200.7 Analysis Name: ICPOE Tot. Rec. Metals

Instrument: ICPOE - PE Optima Work Order: Nu C130709

Analytical Sequence: 1308083 **Total Recoverable** Concentration Units: ug/L

Blank criteria = +/- 5x analyte MDL (+/- PQL)

Analyte	Initial Calibration Blank (1 & 2)	Continuing Calibration Blanks				Method Blank (Batch ID)		PQL
		1	2	3	4	1308068-BLK1	NA	
Nickel	0.34	0.30	0.29	0.08	-0.51	-0.46	NA	10.00
		5	6	7	8			
		1	2	3	4	1308068-BLK1	NA	
Lead	-4.27	-4.71	-7.17	-6.01	-2.69	-3.93	NA	25.00
		5	6	7	8			
		1	2	3	4	1308068-BLK1	NA	
Antimony	9.24	38.90	37.98	46.04	44.31	11.83	NA	100.00
		5	6	7	8			
		1	2	3	4	1308068-BLK1	NA	
Selenium	-5.26	13.23	-5.66	12.97	5.14	-12.94	NA	100.00
		5	6	7	8			
		1	2	3	4	1308068-BLK1	NA	
Thallium	2.83	1.93	7.70	1.53	4.20	-0.85	NA	50.00
		5	6	7	8			
		1	2	3	4	1308068-BLK1	NA	
Vanadium	-0.13	-2.10	-2.04	-2.57	-2.33	-2.93	NA	50.00
		5	6	7	8			
		1	2	3	4	1308068-BLK1	NA	
Zinc	-0.92	-0.18	-1.29	-0.33	-1.02	3.26	NA	20.00
		5	6	7	8			
		1	2	3	4	1308068-BLK1	NA	
Strontium	0.09	-0.04	-0.04	-0.04	-0.07	-0.19	NA	10.00
		5	6	7	8			

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

Mettler AT Method: 150.1 Analysis Name: WC-pH

Sequence: 1307088 Work Order: C130709 Units: pH Units

WET Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
pH					1			2			3	
					4			5			6	
					7			8			9	

Metals - ICV & CCV %R Criteria = 90 - 110%, Classical Chemistry %R Criteria - ICV = 90 - 110%R, CCV = 80 - 120%R.

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPOE - PE Optima Method: EPA 200.2/200.7 Analysis Name: ICPOE Tot. Rec. Metals

Sequence: 1308081 Work Order: C130709 Units: mg/kg dry wt

Total Recoverable Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Aluminum	12500	12737	101.9		1			2			3	
				12500	12617	100.9						
					4			5			6	
					7			8			9	
Antimony	2500	2502.4	100.1		1			2			3	
				2500	2419.0	96.8						
					4			5			6	
					7			8			9	
Arsenic	2500	2572.0	102.9		1			2			3	
				2500	2537.1	101.5						
					4			5			6	
					7			8			9	
Barium	500	506.75	101.4		1			2			3	
				500	501.91	100.4						
					4			5			6	
					7			8			9	
Beryllium	500	506.71	101.3		1			2			3	
				500	505.56	101.1						
					4			5			6	
					7			8			9	
Cadmium	500	516.34	103.3		1			2			3	
				500	509.44	101.9						
					4			5			6	
					7			8			9	

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPOE - PE Optima Method: EPA 200.2/200.7 Analysis Name: ICPOE Tot. Rec. Metals

Sequence: 1308081 Work Order: C130709 Units: mg/kg dry wt

Total Recoverable Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Calcium	12500	12682	101.5		1			2			3	
				12500	12665	101.3						
					4			5			6	
					7			8			9	
Chromium	2500	2558.2	102.3		1			2			3	
				2500	2515.2	100.6						
					4			5			6	
					7			8			9	
Cobalt	500	510.90	102.2		1			2			3	
				500	507.48	101.5						
					4			5			6	
					7			8			9	
Copper	1000	1007.7	100.8		1			2			3	
				1000	1003.8	100.4						
					4			5			6	
					7			8			9	
Iron	12500	12940	103.5		1			2			3	
				12500	12731	101.8						
					4			5			6	
					7			8			9	
Lead	2500	2532.4	101.3		1			2			3	
				2500	2522.0	100.9						
					4			5			6	
					7			8			9	

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPOE - PE Optima Method: EPA 200.2/200.7 Analysis Name: ICPOE Tot. Rec. Metals

Sequence: 1308081 Work Order: C130709 Units: mg/kg dry wt

Total Recoverable Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Magnesium	12500	12852	102.8		1			2			3	
				12500	12640	101.1						
					4			5			6	
					7			8			9	
Manganese	1000	1023.9	102.4		1			2			3	
				1000	1018.9	101.9						
					4			5			6	
					7			8			9	
Molybdenum	500	505.91	101.2		1			2			3	
				500	497.73	99.5						
					4			5			6	
					7			8			9	
Nickel	2500	2572.1	102.9		1			2			3	
				2500	2548.5	101.9						
					4			5			6	
					7			8			9	
Potassium	25000	25393	101.6		1			2			3	
				25000	25143	100.6						
					4			5			6	
					7			8			9	
Selenium	2500	2529.8	101.2		1			2			3	
				2500	2543.2	101.7						
					4			5			6	
					7			8			9	

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPOE - PE Optima Method: EPA 200.2/200.7 Analysis Name: ICPOE Tot. Rec. Metals

Sequence: 1308081 Work Order: C130709 Units: mg/kg dry wt

Total Recoverable Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Silver	250	258.55	103.4	1			2			3		
				250	255.25	102.1						
				4			5			6		
				7			8			9		
Sodium	12500	12743	101.9	1			2			3		
				12500	12536	100.3						
				4			5			6		
				7			8			9		
Strontium	500	513.60	102.7	1			2			3		
				500	509.99	102.0						
				4			5			6		
				7			8			9		
Thallium	2500	2585.2	103.4	1			2			3		
				2500	2558.7	102.3						
				4			5			6		
				7			8			9		
Vanadium	1000	1015.4	101.5	1			2			3		
				1000	1000.2	100.0						
				4			5			6		
				7			8			9		
Zinc	2500	2574.2	103.0	1			2			3		
				2500	2559.8	102.4						
				4			5			6		
				7			8			9		

Metals - ICV & CCV %R Criteria = 90 - 110%, Classical Chemistry %R Criteria - ICV = 90 - 110%R, CCV = 80 - 120%R.

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPOE - PE Optima Method: 200.7 Analysis Name: ICPOE Diss. Metals

Sequence: 1308082 Work Order: C130709 Units: ug/L

Dissolved Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Aluminum	12500	12740	101.9	1			2			3		
				12500	12620	101.0	12500	12510	100.1			
				4			5			6		
				7			8			9		
Antimony	2500	2502	100.1	1			2			3		
				2500	2419	96.8	2500	2409	96.4			
				4			5			6		
				7			8			9		
Arsenic	2500	2572	102.9	1			2			3		
				2500	2537	101.5	2500	2553	102.1			
				4			5			6		
				7			8			9		
Barium	500	506.8	101.4	1			2			3		
				500	501.9	100.4	500	497.7	99.5			
				4			5			6		
				7			8			9		
Beryllium	500	506.7	101.3	1			2			3		
				500	505.6	101.1	500	502.8	100.6			
				4			5			6		
				7			8			9		
Cadmium	500	516.3	103.3	1			2			3		
				500	509.4	101.9	500	506.3	101.3			
				4			5			6		
				7			8			9		

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPOE - PE Optima Method: 200.7 Analysis Name: ICPOE Diss. Metals

Sequence: 1308082 Work Order: C130709 Units: ug/L

Dissolved Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Calcium	12500	12680	101.4	1			2			3		
				12500	12670	101.4	12500	12630	101.0			
				4			5			6		
				7			8			9		
Chromium	2500	2558	102.3	1			2			3		
				2500	2515	100.6	2500	2489	99.6			
				4			5			6		
				7			8			9		
Cobalt	500	510.9	102.2	1			2			3		
				500	507.5	101.5	500	503.4	100.7			
				4			5			6		
				7			8			9		
Copper	1000	1008	100.8	1			2			3		
				1000	1004	100.4	1000	993.8	99.4			
				4			5			6		
				7			8			9		
Iron	12500	12940	103.5	1			2			3		
				12500	12730	101.8	12500	12790	102.3			
				4			5			6		
				7			8			9		
Lead	2500	2532	101.3	1			2			3		
				2500	2522	100.9	2500	2511	100.4			
				4			5			6		
				7			8			9		

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPOE - PE Optima Method: 200.7 Analysis Name: ICPOE Diss. Metals

Sequence: 1308082 Work Order: C130709 Units: ug/L

Dissolved Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Magnesium	12500	12850	102.8	1			2			3		
				12500	12640	101.1	12500	12620	101.0			
				4			5			6		
				7			8			9		
Manganese	1000	1024	102.4	1			2			3		
				1000	1019	101.9	1000	1010	101.0			
				4			5			6		
				7			8			9		
Molybdenum	500	505.9	101.2	1			2			3		
				500	497.7	99.5	500	492.6	98.5			
				4			5			6		
				7			8			9		
Nickel	2500	2572	102.9	1			2			3		
				2500	2548	101.9	2500	2533	101.3			
				4			5			6		
				7			8			9		
Potassium	25000	25390	101.6	1			2			3		
				25000	25140	100.6	25000	24960	99.8			
				4			5			6		
				7			8			9		
Selenium	2500	2530	101.2	1			2			3		
				2500	2543	101.7	2500	2534	101.4			
				4			5			6		
				7			8			9		

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPOE - PE Optima Method: 200.7 Analysis Name: ICPOE Diss. Metals

Sequence: 1308082 Work Order: C130709 Units: ug/L

Dissolved Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Silver	250	258.5	103.4	1			2			3		
				250	255.2	102.1	250	253.8	101.5			
				4			5			6		
				7			8			9		
Sodium	12500	12740	101.9	1			2			3		
				12500	12540	100.3	12500	12570	100.6			
				4			5			6		
				7			8			9		
Strontium	500	513.6	102.7	1			2			3		
				500	510.0	102.0	500	505.6	101.1			
				4			5			6		
				7			8			9		
Thallium	2500	2585	103.4	1			2			3		
				2500	2559	102.4	2500	2529	101.2			
				4			5			6		
				7			8			9		
Vanadium	1000	1015	101.5	1			2			3		
				1000	1000	100.0	1000	992.7	99.3			
				4			5			6		
				7			8			9		
Zinc	2500	2574	103.0	1			2			3		
				2500	2560	102.4	2500	2544	101.8			
				4			5			6		
				7			8			9		

Metals - ICV & CCV %R Criteria = 90 - 110%, Classical Chemistry %R Criteria - ICV = 90 - 110%R, CCV = 80 - 120%R.

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPOE - PE Optima Method: 200.7 Analysis Name: ICPOE Tot. Rec. Metals

Sequence: 1308083 Work Order: C130709 Units: ug/L

Total Recoverable Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Aluminum	12500	12740	101.9		1			2			3	
				12500	12620	101.0	12500	12510	100.1	12500	12650	101.2
					4			5			6	
				12500	12650	101.2						
					7			8			9	
Antimony	2500	2502	100.1		1			2			3	
				2500	2419	96.8	2500	2409	96.4	2500	2417	96.7
					4			5			6	
				2500	2409	96.4						
					7			8			9	
Arsenic	2500	2572	102.9		1			2			3	
				2500	2537	101.5	2500	2553	102.1	2500	2547	101.9
					4			5			6	
				2500	2536	101.4						
					7			8			9	
Barium	500	506.8	101.4		1			2			3	
				500	501.9	100.4	500	497.7	99.5	500	499.0	99.8
					4			5			6	
				500	501.0	100.2						
					7			8			9	
Beryllium	500	506.7	101.3		1			2			3	
				500	505.6	101.1	500	502.8	100.6	500	504.7	100.9
					4			5			6	
				500	505.3	101.1						
					7			8			9	
Cadmium	500	516.3	103.3		1			2			3	
				500	509.4	101.9	500	506.3	101.3	500	504.4	100.9
					4			5			6	
				500	507.3	101.5						
					7			8			9	

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPOE - PE Optima Method: 200.7 Analysis Name: ICPOE Tot. Rec. Metals

Sequence: 1308083 Work Order: C130709 Units: ug/L

Total Recoverable Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Calcium	12500	12680	101.4	1			2			3		
				12500	12670	101.4	12500	12630	101.0	12500	12670	101.4
				4			5			6		
				12500	12560	100.5						
				7			8			9		
Chromium	2500	2558	102.3	1			2			3		
				2500	2515	100.6	2500	2489	99.6	2500	2488	99.5
				4			5			6		
				2500	2508	100.3						
				7			8			9		
Cobalt	500	510.9	102.2	1			2			3		
				500	507.5	101.5	500	503.4	100.7	500	507.7	101.5
				4			5			6		
				500	505.9	101.2						
				7			8			9		
Copper	1000	1008	100.8	1			2			3		
				1000	1004	100.4	1000	993.8	99.4	1000	996.5	99.7
				4			5			6		
				1000	1002	100.2						
				7			8			9		
Iron	12500	12940	103.5	1			2			3		
				12500	12730	101.8	12500	12790	102.3	12500	12740	101.9
				4			5			6		
				12500	12500	100.0						
				7			8			9		
Lead	2500	2532	101.3	1			2			3		
				2500	2522	100.9	2500	2511	100.4	2500	2520	100.8
				4			5			6		
				2500	2512	100.5						
				7			8			9		

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPOE - PE Optima Method: 200.7 Analysis Name: ICPOE Tot. Rec. Metals

Sequence: 1308083 Work Order: C130709 Units: ug/L

Total Recoverable Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Magnesium	12500	12850	102.8		1			2			3	
				12500	12640	101.1	12500	12620	101.0	12500	12730	101.8
					4			5			6	
				12500	12720	101.8						
					7			8			9	
Manganese	1000	1024	102.4		1			2			3	
				1000	1019	101.9	1000	1010	101.0	1000	1016	101.6
					4			5			6	
				1000	1018	101.8						
					7			8			9	
Molybdenum	500	505.9	101.2		1			2			3	
				500	497.7	99.5	500	492.6	98.5	500	495.4	99.1
					4			5			6	
				500	498.5	99.7						
					7			8			9	
Nickel	2500	2572	102.9		1			2			3	
				2500	2548	101.9	2500	2533	101.3	2500	2550	102.0
					4			5			6	
				2500	2543	101.7						
					7			8			9	
Potassium	25000	25390	101.6		1			2			3	
				25000	25140	100.6	25000	24960	99.8	25000	25330	101.3
					4			5			6	
				25000	25390	101.6						
					7			8			9	
Selenium	2500	2530	101.2		1			2			3	
				2500	2543	101.7	2500	2534	101.4	2500	2525	101.0
					4			5			6	
				2500	2518	100.7						
					7			8			9	

TechLaw, Inc. - ESAT Region 8

Initial and Continuing Calibration Verification Results

ICPOE - PE Optima Method: 200.7 Analysis Name: ICPOE Tot. Rec. Metals

Sequence: 1308083 Work Order: C130709 Units: ug/L

Total Recoverable Analyte	Initial (ICV1, ICV2)			Continuing Calibration Verification Standards (CCVs)								
	True	Found	%R	True	Found	%R	True	Found	%R	True	Found	%R
Silver	250	258.5	103.4		1			2			3	
				250	255.2	102.1	250	253.8	101.5	250	254.0	101.6
					4			5			6	
				250	254.2	101.7						
					7			8			9	
Sodium	12500	12740	101.9		1			2			3	
				12500	12540	100.3	12500	12570	100.6	12500	12710	101.7
					4			5			6	
				12500	12740	101.9						
					7			8			9	
Strontium	500	513.6	102.7		1			2			3	
				500	510.0	102.0	500	505.6	101.1	500	508.0	101.6
					4			5			6	
				500	509.1	101.8						
					7			8			9	
Thallium	2500	2585	103.4		1			2			3	
				2500	2559	102.4	2500	2529	101.2	2500	2574	103.0
					4			5			6	
				2500	2555	102.2						
					7			8			9	
Vanadium	1000	1015	101.5		1			2			3	
				1000	1000	100.0	1000	992.7	99.3	1000	993.7	99.4
					4			5			6	
				1000	998.2	99.8						
					7			8			9	
Zinc	2500	2574	103.0		1			2			3	
				2500	2560	102.4	2500	2544	101.8	2500	2559	102.4
					4			5			6	
				2500	2554	102.2						
					7			8			9	

Metals - ICV & CCV %R Criteria = 90 - 110%, Classical Chemistry %R Criteria - ICV = 90 - 110%R, CCV = 80 - 120%R.

TechLaw, Inc. - ESAT Region 8

ICP Interference Check Sample

ICPOE - PE Optima

Analyte	Check Sample	Result*	Units	True	%R	PQL
Sequence: 1308081 Analysis: ICPOE Tot. Rec. Metals						
Aluminum	IFA1	58,139.7	ug/L	60,000	97	50.0
	IFB1	57,879.2	ug/L	60,000	96	50.0
Antimony	IFA1	44.1	ug/L			100
	IFB1	953.2	ug/L	1,000	95	100
Arsenic	IFA1	15.0	ug/L			100
	IFB1	1,039.5	ug/L	1,000	104	100
Barium	IFA1	-4.4	ug/L			5.00
	IFB1	292.7	ug/L	300	98	5.00
Beryllium	IFA1	-0.8	ug/L			5.00
	IFB1	97.7	ug/L	100	98	5.00
Cadmium	IFA1	-5.0	ug/L			5.00
	IFB1	292.2	ug/L	300	97	5.00
Calcium	IFA1	278,691.9	ug/L	300,000	93	250
	IFB1	277,256.1	ug/L	300,000	92	250
Chromium	IFA1	-1.8	ug/L			5.00
	IFB1	302.0	ug/L	300	101	5.00
Cobalt	IFA1	4.7	ug/L			5.00
	IFB1	293.4	ug/L	300	98	5.00
Copper	IFA1	1.2	ug/L			2.00
	IFB1	303.3	ug/L	300	101	2.00
Iron	IFA1	227,275.4	ug/L	250,000	91	250
	IFB1	227,452.8	ug/L	250,000	91	250
Lead	IFA1	2.2	ug/L			25.0
	IFB1	984.8	ug/L	1,000	98	25.0
Magnesium	IFA1	134,878.3	ug/L	150,000	90	250
	IFB1	135,006.2	ug/L	150,000	90	250
Manganese	IFA1	-0.3	ug/L			5.00
	IFB1	199.4	ug/L	200	100	5.00
Molybdenum	IFA1	-7.0	ug/L			20.0
	IFB1	292.7	ug/L	300	98	20.0
Nickel	IFA1	0.3	ug/L			10.0
	IFB1	286.3	ug/L	300	95	10.0
Potassium	IFA1	-115.0	ug/L			1000
	IFB1	20,532.9	ug/L	20,000	103	1000

TechLaw, Inc. - ESAT Region 8

ICP Interference Check Sample

ICPOE - PE Optima

Analyte	Check Sample	Result*	Units	True	%R	PQL
Sequence: 1308081 Analysis: ICPOE Tot. Rec. Metals						
Selenium	IFA1	-34.8	ug/L			100
	IFB1	469.7	ug/L	500	94	100
Silver	IFA1	6.9	ug/L			10.0
	IFB1	324.9	ug/L	300	108	10.0
Sodium	IFA1	49,453.8	ug/L	50,000	99	1000
	IFB1	49,089.5	ug/L	50,000	98	1000
Strontium	IFA1	-1.4	ug/L			10.0
	IFB1	996.3	ug/L	1,000	100	10.0
Thallium	IFA1	3.7	ug/L			50.0
	IFB1	994.5	ug/L	1,000	99	50.0
Vanadium	IFA1	-10.6	ug/L			50.0
	IFB1	301.8	ug/L	300	101	50.0
Zinc	IFA1	0.2	ug/L			20.0
	IFB1	285.2	ug/L	300	95	20.0

*Criteria = 80-120%R of True Value or+/- PQL

See raw data for complete analyte list and results.

TechLaw, Inc. - ESAT Region 8

ICP Interference Check Sample

ICPOE - PE Optima

Analyte	Check Sample	Result*	Units	True	%R	PQL
Sequence: 1308082 Analysis: ICPOE Diss. Metals						
Aluminum	IFA1	58,139.7	ug/L	60,000	97	50.0
	IFB1	57,879.2	ug/L	60,000	96	50.0
Antimony	IFA1	44.1	ug/L			100
	IFB1	953.2	ug/L	1,000	95	100
Arsenic	IFA1	15.0	ug/L			100
	IFB1	1,039.5	ug/L	1,000	104	100
Barium	IFA1	-4.4	ug/L			5.00
	IFB1	292.7	ug/L	300	98	5.00
Beryllium	IFA1	-0.8	ug/L			5.00
	IFB1	97.7	ug/L	100	98	5.00
Cadmium	IFA1	-5.0	ug/L			5.00
	IFB1	292.2	ug/L	300	97	5.00
Calcium	IFA1	278,691.9	ug/L	300,000	93	100
	IFB1	277,256.1	ug/L	300,000	92	100
Chromium	IFA1	-1.8	ug/L			5.00
	IFB1	302.0	ug/L	300	101	5.00
Cobalt	IFA1	4.7	ug/L			5.00
	IFB1	293.4	ug/L	300	98	5.00
Copper	IFA1	1.2	ug/L			2.00
	IFB1	303.3	ug/L	300	101	2.00
Iron	IFA1	227,275.4	ug/L	250,000	91	250
	IFB1	227,452.8	ug/L	250,000	91	250
Lead	IFA1	2.2	ug/L			25.0
	IFB1	984.8	ug/L	1,000	98	25.0
Magnesium	IFA1	134,878.3	ug/L	150,000	90	250
	IFB1	135,006.2	ug/L	150,000	90	250
Manganese	IFA1	-0.3	ug/L			5.00
	IFB1	199.4	ug/L	200	100	5.00
Molybdenum	IFA1	-7.0	ug/L			20.0
	IFB1	292.7	ug/L	300	98	20.0
Nickel	IFA1	0.3	ug/L			10.0
	IFB1	286.3	ug/L	300	95	10.0
Potassium	IFA1	-115.0	ug/L			1000
	IFB1	20,532.9	ug/L	20,000	103	1000

TechLaw, Inc. - ESAT Region 8

ICP Interference Check Sample

ICPOE - PE Optima

Analyte	Check Sample	Result*	Units	True	%R	PQL
Sequence: 1308082 Analysis: ICPOE Diss. Metals						
Selenium	IFA1	-34.8	ug/L			100
	IFB1	469.7	ug/L	500	94	100
Silver	IFA1	6.9	ug/L			10.0
	IFB1	324.9	ug/L	300	108	10.0
Sodium	IFA1	49,453.8	ug/L	50,000	99	1000
	IFB1	49,089.5	ug/L	50,000	98	1000
Strontium	IFA1	-1.4	ug/L			10.0
	IFB1	996.3	ug/L	1,000	100	10.0
Thallium	IFA1	3.7	ug/L			50.0
	IFB1	994.5	ug/L	1,000	99	50.0
Vanadium	IFA1	-10.6	ug/L			50.0
	IFB1	301.8	ug/L	300	101	50.0
Zinc	IFA1	0.2	ug/L			20.0
	IFB1	285.2	ug/L	300	95	20.0

*Criteria = 80-120%R of True Value or+/- PQL

See raw data for complete analyte list and results.

TechLaw, Inc. - ESAT Region 8

ICP Interference Check Sample

ICPOE - PE Optima

Analyte	Check Sample	Result*	Units	True	%R	PQL
Sequence: 1308083 Analysis: ICPOE Tot. Rec. Metals						
Aluminum	IFA1	58,139.7	ug/L	60,000	97	50.0
	IFB1	57,879.2	ug/L	60,000	96	50.0
Antimony	IFA1	44.1	ug/L			100
	IFB1	953.2	ug/L	1,000	95	100
Arsenic	IFA1	15.0	ug/L			100
	IFB1	1,039.5	ug/L	1,000	104	100
Barium	IFA1	-4.4	ug/L			5.00
	IFB1	292.7	ug/L	300	98	5.00
Beryllium	IFA1	-0.8	ug/L			5.00
	IFB1	97.7	ug/L	100	98	5.00
Cadmium	IFA1	-5.0	ug/L			5.00
	IFB1	292.2	ug/L	300	97	5.00
Calcium	IFA1	278,691.9	ug/L	300,000	93	100
	IFB1	277,256.1	ug/L	300,000	92	100
Chromium	IFA1	-1.8	ug/L			5.00
	IFB1	302.0	ug/L	300	101	5.00
Cobalt	IFA1	4.7	ug/L			5.00
	IFB1	293.4	ug/L	300	98	5.00
Copper	IFA1	1.2	ug/L			2.00
	IFB1	303.3	ug/L	300	101	2.00
Iron	IFA1	227,275.4	ug/L	250,000	91	250
	IFB1	227,452.8	ug/L	250,000	91	250
Lead	IFA1	2.2	ug/L			25.0
	IFB1	984.8	ug/L	1,000	98	25.0
Magnesium	IFA1	134,878.3	ug/L	150,000	90	250
	IFB1	135,006.2	ug/L	150,000	90	250
Manganese	IFA1	-0.3	ug/L			5.00
	IFB1	199.4	ug/L	200	100	5.00
Molybdenum	IFA1	-7.0	ug/L			20.0
	IFB1	292.7	ug/L	300	98	20.0
Nickel	IFA1	0.3	ug/L			10.0
	IFB1	286.3	ug/L	300	95	10.0
Potassium	IFA1	-115.0	ug/L			1000
	IFB1	20,532.9	ug/L	20,000	103	1000

TechLaw, Inc. - ESAT Region 8

ICP Interference Check Sample

ICPOE - PE Optima

Analyte	Check Sample	Result*	Units	True	%R	PQL
Sequence: 1308083 Analysis: ICPOE Tot. Rec. Metals						
Selenium	IFA1	-34.8	ug/L			100
	IFB1	469.7	ug/L	500	94	100
Silver	IFA1	6.9	ug/L			10.0
	IFB1	324.9	ug/L	300	108	10.0
Sodium	IFA1	49,453.8	ug/L	50,000	99	1000
	IFB1	49,089.5	ug/L	50,000	98	1000
Strontium	IFA1	-1.4	ug/L			10.0
	IFB1	996.3	ug/L	1,000	100	10.0
Thallium	IFA1	3.7	ug/L			50.0
	IFB1	994.5	ug/L	1,000	99	50.0
Vanadium	IFA1	-10.6	ug/L			50.0
	IFB1	301.8	ug/L	300	101	50.0
Zinc	IFA1	0.2	ug/L			20.0
	IFB1	285.2	ug/L	300	95	20.0

*Criteria = 80-120%R of True Value or+/- PQL

See raw data for complete analyte list and results.

TechLaw, Inc. - ESAT Region 8

Detection Limit (PQL) Standard

ICPOE - PE Optima

Metals (Dissolved) by EPA 200/7000 Series Methods

Sequence: 1308082

Analyte	True	Found	%R	Units
Aluminum	100	96.66	97	ug/L
Antimony	50.0	44.40	89	ug/L
Arsenic	50.0	52.92	106	ug/L
Barium	10.0	10.21	102	ug/L
Beryllium	5.00	4.909	98	ug/L
Cadmium	10.0	10.43	104	ug/L
Calcium	250	253.7	101	ug/L
Chromium	10.0	9.914	99	ug/L
Cobalt	10.0	10.21	102	ug/L
Copper	10.0	9.404	94	ug/L
Iron	100	107.8	108	ug/L
Lead	30.0	29.54	98	ug/L
Magnesium	1000	1040	104	ug/L
Manganese	10.0	10.53	105	ug/L
Molybdenum	10.0	11.71	117	ug/L
Nickel	10.0	10.67	107	ug/L
Potassium	1000	1048	105	ug/L
Selenium	100	107.2	107	ug/L
Silver	10.0	10.70	107	ug/L
Sodium	1000	1056	106	ug/L
Strontium	10.0	10.46	105	ug/L
Thallium	50.0	57.09	114	ug/L
Vanadium	50.0	50.40	101	ug/L
Zinc	50.0	53.17	106	ug/L

Recovery Control Limits: 70-130% except Pb, Tl, Sb, & Hg at 50-150%.No limits for Al, Ca, Fe, K, Mg & Na.

TechLaw, Inc. - ESAT Region 8
Detection Limit (PQL) Standard
ICPOE - PE Optima

Metals (Total Recov) by EPA 200/7000 Series Methods

Sequence: 1308081

Analyte	True	Found	%R	Units
Aluminum	100	96.665	97	ug/L
Antimony	50.0	44.396	89	ug/L
Arsenic	50.0	52.919	106	ug/L
Barium	10.0	10.207	102	ug/L
Beryllium	5.00	4.9091	98	ug/L
Cadmium	10.0	10.427	104	ug/L
Calcium	250	253.71	101	ug/L
Chromium	10.0	9.9138	99	ug/L
Cobalt	10.0	10.212	102	ug/L
Copper	10.0	9.4045	94	ug/L
Iron	100	107.80	108	ug/L
Lead	30.0	29.542	98	ug/L
Magnesium	1000	1039.5	104	ug/L
Manganese	10.0	10.527	105	ug/L
Molybdenum	10.0	11.709	117	ug/L
Nickel	10.0	10.674	107	ug/L
Potassium	1000	1048.2	105	ug/L
Selenium	100	107.15	107	ug/L
Silver	10.0	10.700	107	ug/L
Sodium	1000	1055.8	106	ug/L
Strontium	10.0	10.456	105	ug/L
Thallium	50.0	57.086	114	ug/L
Vanadium	50.0	50.397	101	ug/L
Zinc	50.0	53.167	106	ug/L

Recovery Control Limits: 70-130% except Pb, Tl, Sb, & Hg at 50-150%.No limits for Al, Ca, Fe, K, Mg & Na.

TechLaw, Inc. - ESAT Region 8
Detection Limit (PQL) Standard
ICPOE - PE Optima

Metals (Total Recov) by EPA 200/7000 Series Methods

Sequence: 1308083

Analyte	True	Found	%R	Units
Aluminum	100	96.66	97	ug/L
Antimony	50.0	44.40	89	ug/L
Arsenic	50.0	52.92	106	ug/L
Barium	10.0	10.21	102	ug/L
Beryllium	5.00	4.909	98	ug/L
Cadmium	10.0	10.43	104	ug/L
Calcium	250	253.7	101	ug/L
Chromium	10.0	9.914	99	ug/L
Cobalt	10.0	10.21	102	ug/L
Copper	10.0	9.404	94	ug/L
Iron	100	107.8	108	ug/L
Lead	30.0	29.54	98	ug/L
Magnesium	1000	1040	104	ug/L
Manganese	10.0	10.53	105	ug/L
Molybdenum	10.0	11.71	117	ug/L
Nickel	10.0	10.67	107	ug/L
Potassium	1000	1048	105	ug/L
Selenium	100	107.2	107	ug/L
Silver	10.0	10.70	107	ug/L
Sodium	1000	1056	106	ug/L
Strontium	10.0	10.46	105	ug/L
Thallium	50.0	57.09	114	ug/L
Vanadium	50.0	50.40	101	ug/L
Zinc	50.0	53.17	106	ug/L

Recovery Control Limits: 70-130% except Pb, Tl, Sb, & Hg at 50-150%.No limits for Al, Ca, Fe, K, Mg & Na.

TechLaw Inc., ESAT Region 8

INSTRUMENT ANALYSIS SEQUENCE LOG

Analytical Method: 150.1 **WET** **Sequence ID#:** 1307088

Instrument ID #: Mettler AT Water **LSR #:** DG-382

Analysis ID	Sample Name	Analysis Date	Analysis Time
C130709-02	CR 110 MM 3	07/24/13	11:43

TechLaw Inc., ESAT Region 8

INSTRUMENT ANALYSIS SEQUENCE LOG

Analytical Method: EPA 200.2/200.7 **Total Recoverable** **Sequence ID#:** 1308081

Instrument ID #: ICPOE - PE Optima Soil **LSR #:** DG-382

Analysis ID	Sample Name	Analysis Date	Analysis Time
1308081-ICV1	Initial Cal Check	08/21/13	10:33
1308081-SCV1	Secondary Cal Check	08/21/13	10:36
1308081-ICB1	Initial Cal Blank	08/21/13	10:39
1308081-CRL1	Instrument RL Check	08/21/13	10:42
1308081-IFA1	Interference Check A	08/21/13	10:45
1308081-IFB1	Interference Check B	08/21/13	10:49
1308069-BLK1	Blank	08/21/13	10:53
1308069-SRM1	Reference	08/21/13	10:56
C130709-04	Settling Pond CR 110	08/21/13	10:59
1308069-DUP1	Duplicate	08/21/13	11:02
1308081-SRD1	Serial Dilution	08/21/13	11:05
1308069-MS1	Matrix Spike	08/21/13	11:08
1308069-MSD1	Matrix Spike Dup	08/21/13	11:10
1308069-PS1	Post Spike	08/21/13	11:13
1308081-CCV1	Calibration Check	08/21/13	11:19
1308081-CCB1	Calibration Blank	08/21/13	11:22

TechLaw Inc., ESAT Region 8

INSTRUMENT ANALYSIS SEQUENCE LOG

Analytical Method: 200.7 **Dissolved** **Sequence ID#:** 1308082

Instrument ID #: ICPOE - PE Optima Water **LSR #:** DG-382

Analysis ID	Sample Name	Analysis Date	Analysis Time
1308082-ICV1	Initial Cal Check	08/21/13	10:33
1308082-SCV1	Secondary Cal Check	08/21/13	10:36
1308082-ICB1	Initial Cal Blank	08/21/13	10:39
1308082-CRL1	Instrument RL Check	08/21/13	10:42
1308082-IFA1	Interference Check A	08/21/13	10:45
1308082-IFB1	Interference Check B	08/21/13	10:49
1308082-CCV1	Calibration Check	08/21/13	11:19
1308082-CCB1	Calibration Blank	08/21/13	11:22
1308078-BLK1	Blank	08/21/13	11:44
1308078-BS1	Blank Spike	08/21/13	11:53
C130709-03	CR 110 MM 3	08/21/13	11:56
1308078-DUP1	Duplicate	08/21/13	11:59
1308082-SRD1	Serial Dilution	08/21/13	12:02
1308078-MS1	Matrix Spike	08/21/13	12:05
1308078-MSD1	Matrix Spike Dup	08/21/13	12:09
1308082-CCV2	Calibration Check	08/21/13	12:15
1308082-CCB2	Calibration Blank	08/21/13	12:18

TechLaw Inc., ESAT Region 8

INSTRUMENT ANALYSIS SEQUENCE LOG

Analytical Method: 200.7 **Total Recoverable** **Sequence ID#:** 1308083

Instrument ID #: ICPOE - PE Optima Water **LSR #:** DG-382

Analysis ID	Sample Name	Analysis Date	Analysis Time
1308083-ICV1	Initial Cal Check	08/21/13	10:33
1308083-SCV1	Secondary Cal Check	08/21/13	10:36
1308083-ICB1	Initial Cal Blank	08/21/13	10:39
1308083-CRL1	Instrument RL Check	08/21/13	10:42
1308083-IFA1	Interference Check A	08/21/13	10:45
1308083-IFB1	Interference Check B	08/21/13	10:49
1308083-CCV1	Calibration Check	08/21/13	11:19
1308083-CCB1	Calibration Blank	08/21/13	11:22
1308083-CCV2	Calibration Check	08/21/13	12:15
1308083-CCB2	Calibration Blank	08/21/13	12:18
1308068-BLK1	Blank	08/21/13	12:25
1308068-SRM1	Reference	08/21/13	12:28
C130709-01	CR 110 MM 3	08/21/13	12:55
1308083-CCV3	Calibration Check	08/21/13	12:58
1308083-CCB3	Calibration Blank	08/21/13	13:01
1308068-DUP1	Duplicate	08/21/13	13:04
1308083-SRD1	Serial Dilution	08/21/13	13:07
1308068-MS1	Matrix Spike	08/21/13	13:10
1308068-MSD1	Matrix Spike Dup	08/21/13	13:13
1308068-PS1	Post Spike	08/21/13	13:15
1308083-CCV4	Calibration Check	08/21/13	13:25
1308083-CCB4	Calibration Blank	08/21/13	13:28

USEPA
DateShipped: 7/23/2013
CarrierName: hand
AirbillNo:

CHAIN OF CUSTODY RECORD
Site #: 1306-05
Contact Name: Russ Nelson
Contact Phone: 720-505-7007

No: 8-072313-103158-0001
Cooler #:
Lab: ESAT
Lab Phone: 303-312-7708

Lab #	Sample #	Location	Analyses	Matrix	Collected	Numb Cont	Container	Preservative	MS/MSD
	RB071713-SW01	CR 110 MM 3	200.7, 200.8	Surface Water	7/17/2013	1	500 ml poly	None	N
	RB071713-SW01	CR 110 MM 3	pH, TSS, TDS	Surface Water	7/17/2013	1	500 ml poly	None	N
	RB071913-SO01	Settling Pond CR 110	~~ICP-MS~~ 200.7	Soil	7/19/2013	1	500 ml poly	None	N

Special Instructions:

SAMPLES TRANSFERRED FROM
CHAIN OF CUSTODY #

Items/Reason	Relinquished by	Date	Received by	Date	Time	Items/Reason	Relinquished By	Date	Received by	Date	Time
Analysis		7/23/13		7/23/13	12:30						

430709

ESAT Technical Direction Form

Contract No. EPW06033
EPA Region 8

Site ID: 08UP	***Date Issued:*** 7/23/2013	***Date***
TDF ID: DG-382	***Date Updated:*** 8/5/2013	***Closed By:***

Name: Red and Bonita Mine 2013 Analytical Support

Details: The Contractor shall analyze approximately ten aqueous samples for total recoverable and dissolved metals (including hardness calculation) and Hg as indicated in the Analytical Information Section. The samples will be collected by the START Contractor Weston and are expected to be delivered to the ESAT R8 laboratory starting the week ending 8/9/13.

The delivery date is approximate as weather and other factors may delay sampling and shipment.

Site OSC is Steve Way

TO49/Subtask 49b: Inorganic Chemistry

Analytical Information:

MATRIX

☑ Water ☐ Soils ☐ Vegetation ☐ Biota

WET CHEM

☐ TSS ☐ TDS ☐ DOC ☐ Alk ☐ Chloride ☐ Sulfate ☐ Fluoride ☐ Nitrate ☐ Nitrite
Other

METALS

☑ Dissolved ☑ Total Rec Metals ☐ Total ☑ Hardness (Calc)

200.7: ☑ Ag ☑ Al ☑ As ☑ Ba ☑ Be ☐ B ☑ Ca ☑ Cd ☑ Co ☑ Cr ☑ Cu ☑ Fe ☑ K ☑ Mg
☑ Mn ☑ Mo ☑ Na ☑ Ni ☑ Pb ☑ Sb ☑ Se ☑ Sr ☐ Ti ☑ Tl ☑ V ☑ Zn ☐ SiO2

200.8: ☐ Ag ☐ Al ☐ As ☐ Ba ☐ Be ☐ Cd ☐ Co ☐ Cr ☐ Cu ☐ Mn ☐ Mo ☐ Ni ☐ Pb ☐ Sb
☐ Se ☐ Th ☐ Tl ☐ U ☐ V ☐ Zn

7470/7471/747 ☑ Hg

FIBERS

☐ PLM ☐ TEM

Deliverables

ID	*Description*	*Due Date*	*Submission Date*
1	Provide final deliverable package to Task Monitor no later than 30 days after delivery of samples		